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DEPARTMENT OF COMMERCE

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

JULIUS KLEIN, Director

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ASIATIC MARKETS FOR INDUSTRIAL MACHINERY

BY

WALTER H. RASTALL

Trade Commissioner

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ILLUSTRATIONS.

LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE,
BUREAU OF FOREIGN AND DOMESTIC COMMERCE,
Washington, October 16, 1922.

SIR: There is submitted herewith a report on the conditions in the markets for industrial machinery in India, Ceylon, and the countries of the Far East. The author is Walter H. Rastall, present chief of the industrial machinery division of this bureau, who made an extended personal investigation in the regions covered by this monograph. The sections of the report that relate to import duties, trade-marks, and patents have been prepared, in part, by the bureau's division of foreign tariffs.

A notable movement toward industrialization is in progress in the more important Asiatic countries, and Mr. Rastall is decidedly optimistic with regard to the prospects for development. The expansion of manufacturing industries will necessitate large purchases of machinery for Asia, and it is believed that, if our machinery makers cultivate this field judiciously, an increasing percentage of the orders should come to the United States because of the superiority of American designs, workmanship, and methods.

Respectfully,

JULIUS KLEIN,
Director of Bureau.

To Hon. HERBERT HOOVER,
Secretary of Commerce.

FIG. 1.—STEAM HAMMER IN SMALL SHOP OF PAOTINGFU IRON WORKS, NEAR PEKING.

There are many shops which, in a small way, are beginning to use modern equipment.

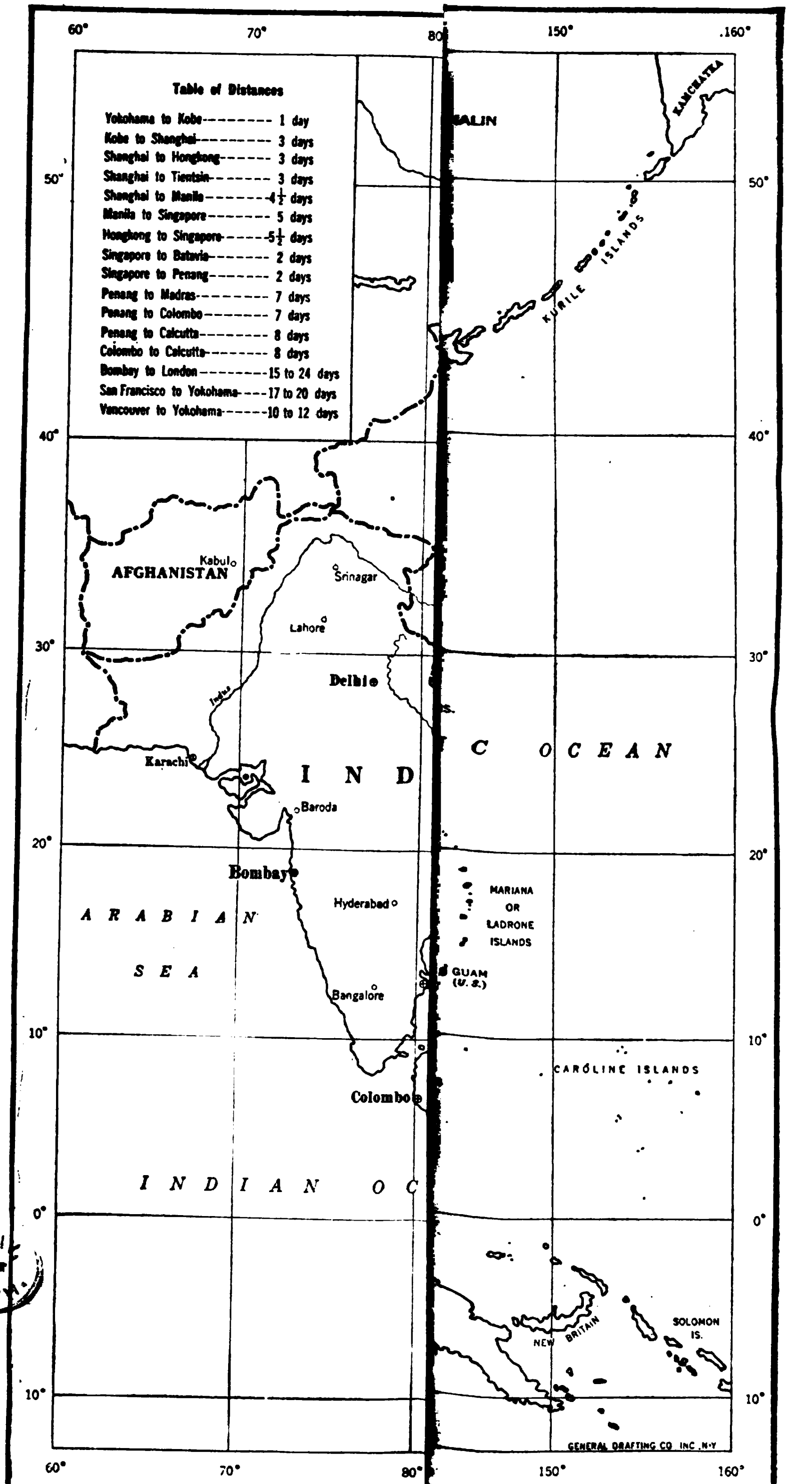
Table of Distances
Yokohama to Kobe---------- 1 day
Kobe to Shanghai---------- 3 days
Shanghai to Hongkong------- 3 days
Shanghai to Tientsin-------- 3 days
Shanghai to Manila--------4½ days
Manila to Singapore--------- 5 days
Hongkong to Singapore------5½ days
Singapore to Batavia-------- 2 days
Singapore to Penang--------- 2 days
Penang to Madras---------- 7 days
Penang to Colombo--------- 7 days
Penang to Calcutta--------- 8 days
Colombo to Calcutta--------- 8 days
Bombay to London---------15 to 24 days
San Francisco to Yokohama----17 to 20 days
Vancouver to Yokohama------10 to 12 days
60°
70°
80°
150°
160°
50°
40°
30°
20°
10°
0°
AFGHANISTAN
Kabul
Srinagar
Lahore
Delhi
Indus
Karachi
Baroda
Bombay
Hyderabad
Bangalore
Colombo
I N D
A R A B I A N
S E A
I N D I A N O C
C O C E A N
KAMCHATKA
KURILE ISLANDS
MARIANA OR LADRONE ISLANDS
GUAM (U. S.)
CAROLINE ISLANDS
NEW BRITAIN
SOLOMON IS.
GENERAL DRAFTING CO. INC. N.Y.

ASIATIC MARKETS FOR INDUSTRIAL MACHINERY.

POSITION OF ASIA IN AMERICA'S MACHINERY TRADE.

CHARACTER AND PURPOSE OF PRESENT SURVEY.

Following 1913 the demand for American factory machinery increased from what was then normal to levels several hundred per cent higher. This was caused by war conditions and was sustained until a time about two years after the armistice, when the demand fell off, leaving the producer in great need of markets. Foreseeing this, the Department of Commerce, a little before the end of hostilities, undertook to prepare for peace. For some years there have been significant changes in the currents of life, thought, and trade throughout the world, and, though many have not realized it, Asia is rapidly rising to a position of much greater importance than has ever been known before. This development is showing itself in a great many ways, one of which is a dollars-and-cents demand for American machinery to be used in the factories of twentieth-century Asia. Year by year the markets of Asia absorb a larger and larger share of our machinery exports, and in order that American manufacturers and exporters of such equipment might have more complete and dependable information regarding these markets the writer was asked to make a full investigation. This involved a personal visit to each of the more important cities between Yokohama and Bombay, requiring about 30 months.

Facing this page is a large, general map of the territories covered, which has been prepared so as to indicate the relative form and size of each; and, as distances are great and as the vessels navigating these waters seldom steam faster than 10 or 12 knots an hour, an effort has been made to show the time consumed in order to get from one place to another. Experience shows that it is difficult for those who have not traveled in Asia to appreciate that it requires as long for one to go from Yokohama to Hongkong as from New York to Liverpool. In many other ways the great distances involved in trade with Asia prove confusing.

The original instructions covering this investigation implied that attention should be given only to machinery as used in and about factories and power plants, but it developed that construction machinery, mining machinery, and certain other types are also sold by the same organizations in Asia that handle factory equipment and so are elements of the same market; consequently, they have been given a certain amount of attention. Very little time has been given to electrical equipment or mining machinery, as those are being covered by separate investigations; reports on some of these have been published, and others are being written.

In its strictest sense this investigation applies to manufacturing and power-plant equipment as used in the maritime countries east of Persia. In a broad sense it covers the problem of selling all types of machinery in all of the countries of Asia, though it does not apply to agricultural machinery, automobiles, cash registers, sewing machines, and similar special lines.

In addition to the more obvious features of such an investigation, an effort has been made to examine into the advertising, financing, and selling methods employed by our foreign competitors as well as by successful American exporters, and certain sections of this report have been prepared with the idea of furnishing the detailed information needed by men who are starting in export work as well as those with more ample experience.

INCREASE IN MACHINERY EXPORTS FROM UNITED STATES.

As the writer sold machinery in Japan from 1904 to 1911, he has had a direct and personal interest in American engineering exports for nearly two decades and felt a certain familiarity with the trade, but the growth of this business in the last few years has been most startling. Omitting typewriters, lawn mowers, and a number of the other items that usually find their way into the machinery classification of the customs returns and confining ourselves strictly to the exports of factory and similar machinery, our total trade expanded over seven times in the decade 1910–1920. The figures for American exports of factory machinery are as follows:

1910	$51,489,598
1913	96,471,072
1915	77,047,331
1918	252,653,049
1919	320,455,759
1920	383,630,357
1921	246,436,364

Unquestionably the war had a profound influence on this development, but, on the other hand, most people appear to believe that the war had a stronger influence than the facts really indicate, for it will be observed that the growth from 1910 to 1913 was most pronounced, and such adverse conditions as have been experienced since the armistice still leave the volume of American machinery exports far above the 1913 level. It is true that 1921 shows a reduction, but, even so, there is a world-wide depression, and the indications are that the decrease in machinery exports is less conspicuous than that for most other commodities. The effect on the returns of increasing and later decreasing prices should be remembered in this connection, as the volume is expressed in dollars rather than quantities.

The importance of export trade to the average American machinery manufacturer is increasing very rapidly. It was not many years ago that the domestic market easily absorbed almost the total domestic production and the rapid development of the home territory provided a satisfactory increase in the domestic demand. This situation is changing, and year by year it is becoming more necessary to cultivate outside markets if business is to show a satisfactory expansion. In 1919 there were in the United States more than 4,000 factories producing industrial machinery, and their product was

valued at more than $2,200,000,000, of which about 17 per cent, or more than $300,000,000, was exported. This 17 per cent often represents the difference between profit and loss in the operation of a plant. It is necessary, more and more, to cultivate these export markets.

DISTRIBUTION OF AMERICAN MACHINERY EXPORTS.

In doing this our foreign-sales managers will consider these outside territories in groups that might conveniently represent routes that could be covered by a traveling representative; and, while the imperfections of the method are recognized, the writer has divided the world into groups or districts to conform to this plan. An American machinery manufacturer looking abroad would consider Asia and Africa somewhat as units. Canada and Newfoundland might be classed together. Mexico and Central America naturally are considered together. Most of South America could be visited on a single journey. Divided in this way, the distribution of the exports of industrial machinery from the United States is shown in the following table, and it will be noted that the comparative importance of these various markets is changing very rapidly. The markets in Europe are, of course, very seriously disturbed:

Regions.	Fiscal years.			Calendar years.		
	1910	1913	1915	1919	1920	1921.
Canada, Newfoundland, etc	$14,368,755	$32,740,377	$15,740,484	$57,490,321	$68,534,672	$28,867,066
Europe (except Balkans)	14,151,707	29,117,195	39,790,973	112,178,313	116,848,098	44,844,196
South America	5,553,574	10,690,991	4,606,836	26,180,072	35,787,203	30,631,382
Mexico and Central America	6,914,500	6,433,548	2,858,474	11,450,859	22,293,921	34,381,861
West Indies, etc	2,923,918	5,375,266	4,466,958	22,248,987	47,087,299	27,146,318
Total Latin America	15,391,992	22,499,805	11,932,268	59,879,918	105,168,423	92,159,561
Asia (except Asia Minor)	3,805,620	6,530,936	4,443,287	73,116,419	71,296,081	64,424,150
Australasia	2,209,862	3,566,129	2,999,898	5,792,748	8,171,153	7,706,546
Africa	1,441,949	1,591,746	1,573,369	5,615,898	7,652,579	4,643,732
Other	119,713	424,884	567,052	6,382,142	5,959,351	3,791,113
Total	51,489,598	96,471,072	77,047,331	320,455,759	383,630,357	246,436,364
Percentage to Asia	7.4	6.8	5.8	22.9	18.5	26.1

The above totals are small as compared with certain other figures that have been published, because only machinery has been included. In some other reports engineering materials are also considered, such as piping, valves, fittings, packing, belting, electrical wire and equipment. All such items are excluded in the above and elsewhere in this report.

The Canadian market is so much like that of the United States and is so intimately associated with it that most American manufacturers will consider their business there as almost a part of the domestic trade. Europe, too, is a most exceptional market; the effects of the war and reconstruction, the language problem, the industrial conditions and those resulting from political, credit, and exchange complications, together with a number of other factors, constitute a very special and abnormal sales problem.

RELATIVE IMPORTANCE OF ASIA IN PURCHASES OF MACHINERY.

Examination of the above table shows that before 1915 each of the three circuits of Latin America was comparable in importance with the Asiatic group, while in the years since 1918 the demand in Asia has more nearly approached the total of the three. In other words, the territories that were covered by the writer in making this investigation, and that might be covered by the traveling representative of a manufacturer, are now taking probably 25 per cent of our exports of factory machinery, as compared with possibly 5 to 7 per cent in the years prior to 1915.

The writer found this a most startling development. The machinery trade of Asia as he found it in 1919–1921 had developed tremendously as compared with the trade he left in 1911. The "unchanging East" is changing rapidly and profoundly. During the last three years Asia has absorbed as much American machinery as it would have taken in five decades if measured by the standards of 1915. And this is a matter of the most profound significance. For a long time great efforts have been made to modernize Asia. Missionary and merchant, teacher and diplomat have worked for progress. Practically every European that visits Asia joins in the demand for reform, and it has been so since the days of Marco Polo; but suddenly, within four years, these markets absorbed some $242,000,000 worth of American industrial machinery. One concludes that, in the confusion of other great events, the significance of this is unnoticed. The potentialities of such a volume of machinery in the hands of the millions of Asia is tremendous, and each of these units is the best possible advertisement and will encourage the installation of more.

Also the market is not as it was in 1911. The pioneer work that involved so much patient toil in former years is now showing results, and the whole continent from Yokohama to Bombay wants to be industrialized. The sales problem there is no longer so difficult or expensive as it was before the war upset the world in 1914, and foreign-sales managers in establishing their policies will do well to consider the cities of Asia as new markets to be restudied in all details. Even the old familiar problems that one had long thought solved, such as packing or advertising, are up again for consideration and need careful thought, as the conditions have changed and that which was satisfactory in 1913 does not meet the conditions of the present day.

THE "LAST NORMAL YEAR."

This investigation was started about the time of the armistice, late in 1918, and at first an effort was made to base comparisons upon the "last normal year"—say 1913—but it has become necessary to recognize that the world has changed. Even in the United States there is no "normal." We can not get back to the old basis. In Asia business is even farther away from the guideposts we once recognized. Even though there had been no war it would have been absurd to attempt to deduce from the returns of 1913 data that would have been a satisfactory guide for 1921—just as we would avoid comparing 1911 with 1903. The world moves too rapidly for that. "Those who claim to be able to find an accurate and inform-

ing analogy between the economic conditions of the pre-war period and those of to-day are misleading themselves." In the industrial life of Asia these changes are more profound than in any other direction of which the writer has knowledge, and, if American business is to-day navigating without charts, the machinery trade of Asia is suffering even more pronounced detachment. There is no possibility of basing comparisons on a "last normal year" if we are to reach conclusions that are useful. The entire world has changed, and industrial Asia is progressing even more rapidly. In establishing sales policies we must be alert to recognize the full significance of the profound changes that have developed since 1915.

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COMPARATIVE IMPORTANCE OF THE ASIATIC MARKETS FOR INDUSTRIAL MACHINERY.

Cities.	Year.	Value.	Approximate value in United States dollars.	Year.	Value.	Approximate value in United States dollars.	Percentage from United States, 1915.	Estimated value to United States in 1915, etc.	Percentage from United States, 1918.	Estimated value to United States in 1918, etc.
Yokohama	1915	Y 2,584,550	1,292,275	1918	Y 18,777,305	9,388,652	31.6	$409,000	80.0	$7,500,000
Kobe	1915	Y 2,685,334	1,342,667	1918	Y 17,472,894	8,736,447	31.6	425,000	80.0	6,990,000
Manila	1915	P 2,409,503	1,204,752	1918	P 7,942,491	3,971,246	73.0	880,000	95.0	3,780,000
Shanghai	1915	H T 2,077,225	1,286,880	1919	H T 5,484,248	7,623,105	14.7	189,000	30.6	2,320,000
Calcutta	1914-15	£ 2,414,391	11,347,638	1918-19	£ 1,609,120	7,562,864	3.3	374,000	24.5	1,850,000
Bombay	1914-15	£ 2,387,127	11,219,497	1918-19	£ 1,535,649	7,217,550	3.3	370,000	24.5	1,770,000
Hongkong	....	....	....	1919	£ 580,427	2,728,007	....	....	47.0	1,330,000
Dairen	1915	H T 493,853	306,189	1919	H T 2,941,746	4,089,027	14.7	45,000	30.6	1,250,000
Tientsin	1915	H T 388,591	240,926	1919	H T 1,870,175	2,599,543	14.7	35,000	30.6	795,000
Soerabaya	1915	F 4,644,000	1,857,600	1918	F 5,465,884	2,186,354	4.7	88,000	35.0	768,000
Hankow	1915	H T 369,953	229,371	1919	H T 1,161,341	1,614,264	14.7	33,000	30.6	495,000
Batavia	1915	F 1,123,000	449,200	1918	F 2,983,995	1,193,598	4.7	21,000	35.0	418,000
Singapore	....	....	....	1917	S $ 1,791,024	1,002,973	....	....	20.4	204,000
Madras	1914-15	£ 432,705	2,033,714	1918-19	£ 176,653	830,269	3.3	67,000	24.5	204,000
Rangoon	1914-15	£ 241,904	1,136,949	1918-19	£ 172,759	811,967	3.3	37,000	24.5	199,000
Samarang	1915	F 1,035,000	414,000	1918	F 1,199,814	479,926	4.7	20,000	35.0	168,000
Penang	....	....	....	1917	S $ 721,977	327,344	1.6	10,000	9.3	31,000
Colombo	1915	R 1,935,547	605,826	1918	R 1,045,828	404,307	....	....	20.4	82,000
Total	....	....	....	....	....	62,767,443	....	....	48.0	30,154,000

NOTE.—The returns for Java ports in 1915 are estimates only. The abbreviation "Y" stands for the Japanese yen, which has been converted at the rate of $0.50; "P" stands for the Philippine peso, also converted at $0.50; "H T" for the Chinese haikwan tael, converted at $0.62 for 1915 and $1.39 for 1919; "£" for the British pound sterling, converted at $4.70; "F" for the Dutch guilder, converted at $0.40; "R" for the Ceylon rupee, converted at $0.313; and "S $" for the Straits Settlements dollar, converted at $0.56.

AMERICAN PARTICIPATION IN MACHINERY MARKETS OF ASIA.

The data given in the table on page 3 are derived from the returns of the United States customs and refer only to American machinery. By consulting the returns issued by the several Asiatic countries we can ascertain what share of their machinery imports are from the United States. In doing this it must be recognized from the start that the returns of two separate countries seldom check. The United States may report certain shipments of machinery to Ceylon, for example, and yet on examination of the returns in the Ceylon Bluebooks it is found that the authorities there either fail to acknowledge receipt of any such quantity or else give values far in excess of the American claims. These discrepancies arise from a great variety of causes, such as the use of arbitrary values, differences in classification, arbitrary fiscal years, the time consumed in transit, etc.

In examining these trade returns it should be remembered that from the close of the Russo-Japanese War until 1914 the machinery trade of Asia was reasonably uniform. Japan was the most important buyer (except possibly India) and startled the world with its progress, while everyone hoped that the other Eastern countries would follow the Japanese example and modernize all Asia. The machinery trade of the whole continent during the years 1905 to 1915 followed a reasonably regular and apparently satisfactory although rather deliberate course and is represented with substantial accuracy by the data for the year 1915 as published in the table on the opposite page, which shows the comparative importance of the markets in the principal cities and the American share in the trade of each. During these years manufacturers and exporters had a rather stable business and knew about what to expect.

DEVELOPMENT OF AMERICAN MACHINERY TRADE IN ASIA.

Some time between 1915 and 1919, however, new forces were released, as has been shown by the statistics of the American customs on page 3 and confirmed by the returns from the various Asiatic countries, as shown in the table opposite. During this interval American machinery exports increased more than a thousand per cent, and this increase has been reasonably well maintained ever since and is being augmented much faster than the corresponding trade with any other part of the world. It will also be noted that the participation of the United States in this trade has increased very rapidly.

The data in this table tempt one to draw the conclusion that this tremendous increase in the Asiatic demand for machinery was caused by the war, but other circumstances suggest that such an inference is not justifiable, because the demand has been so well sustained since the armistice and the markets of Asia are increasing in importance so much more rapidly than is the case elsewhere. There seems to be no relation between the market of the years since 1918 and that of the years prior to 1915. To make this perfectly

clear the following data for exports of American industrial machinery to Asia are repeated:

1910	$3,805,620
1913	6,530,936
1915	4,443,287
1918	33,676,665
1919	73,116,419
1920	71,296,081
1921	64,424,150

Obviously the demand has been sustained for at least three years following the armistice, and data indicate that the trade is on a very different basis from that known previous to 1915. One would conclude that other than war forces are at work, as is also suggested by a comparison of the values for 1913 with those of 1910.

It is the writer's impression that the people of Asia, in all of the countries, appreciate the value of modern industrialism and realize that by the use of machinery they will be able to raise their standard of living. They desire this above almost anything else. They know well the difference between conditions in their countries and those in the industrialized west, and they are very ambitious to better their own conditions. To a greater or less degree they appreciate the superiority of American engineering and American industrial machinery, and whenever money is plentiful they can be relied on to buy. Each year it is becoming easier to promote new enterprises; the existing operators grow in experience and knowledge. The field is a most promising one.

RELATIVE VALUE OF PRINCIPAL ASIATIC MARKETS.

It is common practice to publish returns showing the values of the trade in the different countries, but to a certain extent trade ignores political boundaries. The real machinery markets of Asia are the various cities, not the countries. Hongkong and Shanghai have very little in common, although both are markets for trade in China. Rangoon has nothing in common with Bombay. The data in the table on page 6 have been prepared in an effort to show the comparative importance of the trade in industrial machinery of 18 of the more important cities of Asia and the share of the United States in that trade in 1915 and 1918.

In presenting these figures it is realized that they are subject to criticism. As has been explained, they are based on the returns of several foreign countries and are not uniform as to classification. The exchange rates employed are arbitrary and possibly are not the best that could have been selected. In some instances these figures refer to the calendar year and in others to arbitrary fiscal years. But despite the endless series of questions that might be raised in this connection, it is believed that the impression conveyed by these figures is substantially correct and reliable.

Another serious defect in these returns is the method of arriving at the American share of the business at each port. For instance, it will be noted that this percentage is assumed to be uniform for all of the cities in each country, and obviously this is not true. Unfortunately, the customs returns of the several countries show only the American participation in the trade of the country as a whole. The trade of each port necessarily has been prorated on this basis.

But regardless of such defects, it will be noted that the returns for 1918 check rather closely with those published by the American authorities, and, taken as a whole, all of the returns demonstrate that the machinery trade of Asia is expanding rapidly, that the American participation in that trade is important and increasing, and that the rate of development in all countries is rapid and, everything being considered, shows gratifying progress. In this field Japan is the largest market for machinery, as well as the largest for American machinery. The cities of India rank next in total volume, but usually Manila and the ports of China take a little more American equipment. Up to 1918 the Philippines usually absorbed more American machinery than China, but in 1919, 1920, and 1921 this situation was reversed, as is shown by the following figures from the returns of the American customs:

Years.	Philippines.	China.	Years.	Philippines.	China.
1910	$532,361	$641,732	1919	$10,007,110	$12,149,039
1913	1,489,836	260,431	1920	9,861,830	15,202,914
1915	689,562	414,046	1921	5,529,555	18,184,978
1918	3,753,054	2,744,114			

The markets in the Dutch East Indies and British India are also very important, for while they did not absorb a great deal of American machinery before the war it was because the American participation in the trade was abnormally small. The total amount of machinery purchased is very important. In recent years American equipment is in greater demand, and these markets deserve more careful attention, as is indicated by the following American returns, which correspond to those just given for the exports to the Philippines and China:

Years.	Dutch East Indies.	British India.	Years.	Dutch East Indies.	British India.
1910	$84,448	$516,438	1919	$4,546,249	$4,822,136
1913	424,314	628,063	1920	3,962,705	8,111,594
1915	212,630	625,739	1921	5,061,080	10,772,891
1918	2,171,062	3,635,335			

PRESENT SITUATION AND IMMEDIATE PROBLEMS.

No further demonstration should be necessary to show that this is a time when the best results, in respect to these materials, can be secured by sustained selling effort and advertising. The significance of these figures is tremendous. This $242,000,000 worth of machinery since 1918 represents a very powerful force; the trade has acquired a momentum. This machinery will not stand idle. It will work for the American manufacturer and exporter. It establishes a "good will." An era of depression has followed the feverish boom of the years 1918–1920, but the indications are that trade will largely readjust itself by 1924 and the volume will never fall back to the levels of pre-war days but will remain large and may be expected to expand rapidly. Before leaving Asia the writer asked several of the machinery dealers there to estimate the level

at which it would settle down, and so far as could be learned it was felt that it would be about 60 to 70 per cent of the volume of 1920.

On the whole it appears that we can expect to export to Asia during the next few years an average of about $40,000,000 or $50,000,000 worth of industrial machinery per year, and foreign sales managers would presumably be justified in developing their organizations to correspond with this basis. It will be noted that this is about ten times the volume of the trade in 1915. Allowance and preparation should also be made for a rapidly increasing volume during the following years.

The matter of foreign competition will be referred to on subsequent pages, but it should be noted here that, with the exception of Great Britain, there is no other country that exports anything like the amount of machinery indicated by the foregoing figures. It does not seem probable that foreign competition will disturb this trade to any serious degree. The trade returns for recent years in several of these countries are not yet available but, fortunately, the following Japanese returns have been received, and these indicate the nature of the changes that are taking place as reconstruction in Europe progresses; it should be remembered that Japan is an independent market where purchasers endeavor to buy on merit and political and financial affiliations do not intervene:

Years.	Total machinery imported to Japan.	Percentage from United States.	Percentage from United Kingdom.
	Yen.		
1918	58,497,998	80	17
1919	89,221,936	75	18
1920	110,571,375	66½	25.7
1921	119,882,164	53	36.7

NOTE.—The yen is a gold unit that does not fluctuate very much as compared with United States currency and is worth a little less than 50 American cents.

Even such a reduced participation in trade as is suggested by these figures is of very small significance, for it will be observed that the total value from the United States increased rapidly and continuously (1921 excepted). Also, it is felt that any slight decrease in the American share of this trade is more than made up in gains secured in other Asiatic territories where the American participation, although smaller, has been increasing rapidly.

The above figures speak for themselves and point the way to markets of great present importance, with even better future prospects. But one feels that they represent a situation that is not recognized in this country. The outstanding impression left by the writer's investigation is that many of our manufacturers need to remodel their foreign sales organizations. The business has outgrown its old bounds, and the methods that may have sufficed in 1913 are no longer suitable for the larger business and more perfectly developed markets of the present. The staff that may have met the old conditions is possibly too small or not qualified to handle the work and problems that have developed with such extreme rapidity.

During the months that we experienced a "sellers' market" temporary arrangements were acceptable, but now that foreign buyers are becoming more critical, good management requires the adoption of correct business principles. Of late a great deal of comment on export trade has appeared in the public prints and, as is well known, some of this comment is inaccurate. The present is the time for clear thinking and methodical practices, and manufacturers and exporters are urged to reconsider the whole problem.

The first step is to decide definitely whether to cultivate foreign markets, and this is one of the most serious decisions that many executives are called upon to face, for if the trade is worth cultivating it is worth adequate organization, which will probably involve serious expense before adequate returns are received. No effort will be made here to demonstrate the value of foreign trade. There are important machinery manufacturers in the United States that export from 40 to 60 or more per cent of their product. The effect of this on the prosperity of such companies, the diversity of the markets carrying the manufacturers over periods of localized depression, the beneficial effect on factory, city, and nation of this "imported prosperity" are assumed to be fully recognized. More and more the prosperity of our people depends upon foreign trade.

The fundamentals of the business of exporting machinery are practically the same as for other commodities. The decision to go in or stay out, the executive policy, the sales policy, the study of markets, the handling of agents, salesmen, advertising, and many kindred subjects are covered by a publication entitled "Selling in Foreign Markets," Miscellaneous Series No. 81, issued by the Bureau of Foreign and Domestic Commerce, and obtainable for 50 cents from any district or cooperative office of the bureau or from the Superintendent of Documents, Government Printing Office, Washington, D. C. There is no need to repeat here what has been published previously, but an effort will be made to offer some further particulars which it is thought will make clear some of the problems involved in the exportation of machinery.

ASIA AS COMPARED WITH OTHER MARKETS.

For various reasons more or less sentimental or political or otherwise, many Americans make their first foreign-trade ventures in South America, and probably this was often good policy prior to 1915, as the markets of Latin America were comparatively well developed. Germany's experience justified this trend, as that country sold more factory machinery on the South American circuit than in Africa, Asia, and Australasia put together. On the other hand, the United Kingdom, both before and since 1914, has shipped more machinery to Asia than to South America, Africa, and Australasia combined. The fact that the United Kingdom derived most benefit from the machinery trade of Asia at the same time that Germany profited most from its machinery sales in South America is interesting but not too significant. The German trade was largely in electrical machinery. The British trade was influenced by orders for textile machinery. But it is significant that Germany seemed to get a larger share of the locomotive business of South America than

did the British, while in Asia the position was reversed. This seems to call attention to the merits of the marketing organizations rather than the merits of the locomotives themselves. It also raises the question as to which would have been the better field for American efforts.

The pre-war experience of the United States is interesting in this connection, as the American exports to South America and also to Australia exceeded those sent to Asia by a very heavy percentage. But since that time this situation has been completely changed, as has been shown on the preceding pages. Some neglected markets have been discovered. The German statistics no longer help us and the British exports are largely affected by the conditions of reconstruction. However, the United States may now be expected to send more machinery to Asia than to South America, Africa, and Australia combined.

Those exporters who have done a certain amount of business in Asia will find that their impressions are inaccurate unless they have been formed very carefully and very recently. The group of markets represented by the countries of Asia constitute our best opportunity for the exportation of machinery, for, although the shipments to Europe may show a greater volume, this will probably decrease; there are also complications of language and foreign exchange there that interfere with business.

There are also great differences in the character of the trade of those continents. The machinery shipped to Europe prior to 1919 represented to a large extent, equipment for war purposes and the making of ammunition, while that shipped to Asia was more largely equipment for the normal activities of peaceful times.

ATTRACTIVE FEATURES OF ASIATIC MARKETS.

USE OF ENGLISH AS LANGUAGE OF TRADE.

The markets of Asia have important attractions for the American exporter of machinery. In addition to the large volume and rapid rate of development of the trade transacted there, the simplicity of the language problem is of great assistance. In Europe this problem is very serious, and many tongues are involved. In South America it involves the use of Spanish and Portuguese. In Asia the language of trade is English. One may travel from Bombay to Yokohama and English is the language used in the offices of nearly all of the firms engaged in the machinery trade. Practically every buyer intrusted with authority to purchase machinery knows English well. Even the Japanese and Dutch engineering firms who operate their own business in their own language have plenty of men who are qualified engineers with a fluent knowledge of English. They do not ordinarily expect to be addressed in any other language. Catalogues and advertising matter as used in America quite commonly meet the requirements of the machinery trade in Asia. Similarly one seldom finds it necessary to use the metric system of weights and measurements. Difficulties of translation and correspondence will not ordinarily appear.

EXCHANGE SITUATION AND BALANCE OF TRADE.

The exchange situation also makes Asia an attractive field for sales effort on behalf of American goods. As distinguished from the position in Europe, where the exchanges are so chaotic, and that in South America, where the fluctuations are severe, the situation in Asia is more nearly the 1913 level than can be found elsewhere. At the moment of writing the Philippine rate is on a par with the United States—a position that can not be duplicated in any other country in the world. Japanese exchange has never gone lower than about 4 per cent discount. This also can not be duplicated. The discount in Java is about 10 per cent. The other countries are largely silver countries, and the world market for this metal is reasonably close to the pre-war level. As a whole, the markets for exchange in Asia are remarkably close to normal. On the other hand, American traders have a big advantage over their European competitors in this matter. The actual rate of exchange is not so important in business matters. Business can be transacted on any level so long as it is stable. It is the fluctuations that do the damage. In the markets of Asia, from Yokohama and Manila to Bombay, American exchange is far more steady than that for London, Paris, or Berlin, and Americans reap a corresponding advantage. The importance of this is attested by the fact that German manufacturers frequently quote prices in terms of American money when submitting quotations in South America, Asia, and elsewhere. This matter is far more important than many people realize.

In a recent statement Barclay's Bank, London, remarked of sundry European countries: "The capacity for these countries to absorb our goods is limited by our demand for their products." This is a very concise way of stating the principle that to export we must import or else adjust the balance otherwise—a process that is not always easy. Selling American machinery in certain countries may become difficult for this reason, but the foreign sales manager need not fear that his efforts in Asia will be wasted, because most of these countries ship us more than we sell them. Japan and China send us sufficient silk, tea, and other commodities to more than cover purchases made here, and jute alone, regardless of other merchandise, will pay for machinery purchased for India. If we consider our imports, Americans are entitled to a much larger share of the machinery trade of Asia.

FACTORS STIMULATING INDUSTRIALIZATION.

The operation of steamships, telegraphs, railways, and the plants already installed constantly encourages the establishment of new enterprises. And so, in one way or another, we have reached the point where those 700,000,000 people and the resources of a continent are being opened to industrialization. The standard of living is rising rapidly, education along occidental lines is being disseminated, and Asia demands better facilities. Efforts in such markets give promise of good rewards.

Furthermore, industrialization is possible because fundamentally industry requires population. There are valuable oil nuts decaying on the ground in South America for lack of gatherers. The popu-

lation of Africa will be a difficult problem when the time comes to employ it in factories, and it is not a dense population. Malaysia has largely supplanted Brazil in the rubber markets of the world, because of the employment of abundant labor on plantations instead of seeking the wild rubber. And so in numberless ways the abundant labor of Asia makes industrial development possible. And this applies to the immediate as well as to the remote future. India, China, and Japan all have well-established textile industries that are growing rapidly. Many of these mills have been in operation for years and have demonstrated over long periods that they earn exceedingly good profits. The demand for spindles and looms will be good for many years. Mine development in these and other countries has a similar history. Electric central stations, with both water and steam power, have like records, and Asia can now boast of plants of both kinds of several thousand horsepower each. Once progress of this kind gets started it usually quickens in its development, and when dealing with such large populations it does not require imagination to see the increase in demand that results from even a slight increase in the standard of living.

AMERICAN PRODUCTS WELCOMED.

The markets of Asia have the further attraction of welcoming our products. Recent years have shown diverse and important demands for our machinery, which has been purchased in places and quantities previously unknown. Machine tools, steam boilers, construction equipment, road-making plant, automobiles, railway material—an almost endless variety has been purchased and found good. American cotton mills have been established in Japan and China and the superiority of the machinery and arrangement fully demonstrated. In India the superiority of American equipment in steel mills, water-power plants, and numerous other lines is clearly recognized. Java has taken up American machinery for a variety of purposes, from railway equipment to vegetable-oil mills. From one end of Asia to the other American electrical machinery is admired and purchased because of its superior qualities. The markets have not been overworked; in fact, they have not been adequately developed. Frequently it requires but little salesmanship to sell American equipment. The prospective purchasers welcome those who can offer the materials that are needed, and they offer a great opportunity to such persons as will give them proper attention. The methods to be used are discussed elsewhere.

OTHER FAVORABLE CONDITIONS.

In addition to what has been stated above, we should emphasize that it is unwise to make estimates as to the positive and relative value of these Asiatic markets by means of comparisons with conditions as they existed before the war, because conditions have changed radically. The Chinese revolution came in 1911. China's imports of American machinery in 1919 were four and one-half times the imports in 1917, which, in turn, were a record, and the 1920 business was much larger than that of 1919. In Japan the 1918 returns show an even larger increase over 1916. In the British and Dutch possessions

there is a much stronger tendency toward direct relations where formerly purchases were made through London, The Hague, Amsterdam, or Rotterdam. New steamship lines have been opened up connecting these colonies directly with American ports. Banking facilities are being improved rapidly, and, with the decrease in the influence of these European cities, our opportunities multiply—this being, after all, the normal course of development. The increase in the number of Dutch firms operating in New York testifies to the nature and extent of this change.

PROSPECTS FOR DEVELOPMENT IN FAR EAST.

In making a conservative estimate of the value of a prospective market, due allowance should be made for the natural growth that is to be expected. Under date of July 31, 1921, the National City Bank of New York issued a statement in which it estimated the international trade of the world as follows: 1870, $10,000,000,000; 1900, $20,000,000,000; 1913, $40,000,000,000; 1918, $63,000,000,000; 1920, $100,000,000,000. The same statement adds data indicating the share of manufactured goods in American exports, as follows: 1880, 15 per cent; 1890, 21 per cent; 1900, 35 per cent; 1910, 45 per cent; 1920, 52 per cent. By 1920 the United States furnished approximately one-third of the manufactured goods entering international trade.

The commercial activities of the world are expanding at a prodigious rate. It does not make much difference whether we examine statistics of coal production, railway traffic, cotton spun, or bank clearings, in the Orient or the Occident; there is everywhere the same sort of chart showing a rapidly increasing rate of development. The above bank has also issued the following statement: "The international commerce of the Far East doubled in value during the period 1914–1920, while its trade with the United States quintupled in the same period. It bought from the United States $125,000,000 worth of our products in the year before the war and $750,000,000 worth in the fiscal year 1920, and we bought from it, in turn, $250,000,000 worth in 1914 and $1,250,000,000 worth in 1920. Our 1920 sales in the Far East are six times as much as in 1913 and our purchases therefrom five times as much as in 1913."

Unquestionably the future in these markets is most promising, and it is hoped that, in considering them, American manufacturers and exporters will exercise vision and forethought and in handling this trade will adhere very closely to good business methods.

STANDING OF AMERICAN MACHINERY IN WORLD MARKETS.

IMPORTANCE OF ESTABLISHING COMPARATIVE MERITS.

As soon as one engages in the sale of machinery abroad he is confronted with the products of other countries, and it is necessary to establish the comparative merits of each. This subject is of importance because of its influence on sales and business policy; it is mishandled in conversations on steamships and Pullman cars and elsewhere the world over. Many men have preconceived ideas that are at variance with the facts. The subject deserves attention.

Much has been said regarding the merits of American machinery, but sometimes in such a bombastic way as to fail of conviction. At other times, especially in earlier years, similar reports have suggested the superiority of German equipment, particularly their electrical machinery, chemical products, gas engines, scientific instruments, etc. Then, again, one encounters an admirer of British engineering as represented by textile machinery, marine equipment, locomotives, motor cars, and what not, with stress placed on dependability, strength, weight, etc.

In the Orient one hears tales regarding the ability of the Japanese to produce cleverly and very cheaply an endless variety of equipment, copied perfectly, even such as requires the superior materials and accurate workmanship of a 12-inch gun or a 10,000-horsepower steam turbine. These subjects that are mentioned so glibly in such conversations are really important. It is very rarely indeed that one can get a genuine insight into the situation from these talks, because they misrepresent the facts, and yet, in a sense, they represent prevailing public opinion as to the relative excellence of American machinery, and they measure the salesman's problem. In studying these matters to establish the real engineering merit of the products from various countries, it will at once be found that there are fundamental differences in the engineering practice of the various countries. The steam boilers of the Europeans are often of a type that is rarely if ever used in America; their steam engines are frequently vertical where ours are horizontal; their standards for electrical equipment are different. These differences raise the question as to the comparative merits of each.

REASONS FOR SUPERIORITY OF AMERICAN DESIGNS.

American machinery has been developed in a country where operations are conducted on a larger scale than elsewhere. The amount of machinery per workman is greater than abroad. In 1907-1909 the capital invested per workman in the United States was £483 as compared with only £212 in the United Kingdom.[1] In other words,

[1] See "Labor Unrest in England," in the issue of "The Nineteenth Century and After" for June, 1919."

when an American designer starts on a new machine, consciously or unconsciously, he plans to invest up to $2,300 per workman, whereas the British designer limits himself to about $1,000. Obviously the American designer develops the better-planned unit. Also, this does not mean that the American machine is simply equipped with some additional convenience or labor-saving attachment, but this 130 per cent increased investment is worked into every detail of the American designs. By this we know a "modern" from an old-style machine. Europe and Asia have not yet worked up their designs to these high standards.

The claims of long life frequently made on behalf of European designs often represent underloading. The life of a well-made marine or factory engine is in excess of 20 years at full load and speed; the life of an equally "good" automobile engine probably would not exceed 90 days and that of a very good airplane engine not over 200 hours. But if the automobile is not worked it may easily "run" 10 years. This claim of long life on behalf of European equipment is probably made in connection with locomotives as often as anywhere, but, outside of the United States, where can one find locomotives handling trains of over 4,000 tons net as a matter of daily routine? In an article by the Right Hon. Sir Eric Geddes, His Majesty's Minister for Transport, as published in the London Magazine for March, 1921, is the following statement of the British position:

> In this country we actually get less goods traffic over each mile of running track per annum than was obtained in pre-war days in Prussia, Germany, Belgium, the United States, and other countries. Our average net or paying trainload is 134 tons of freight; in the United States, in 1917, it was 533 tons; and in Prussia, in pre-war days, it was 236 tons. To raise the trainload by 10 tons would mean a saving in haulage costs above £1,700,000 a year. To raise the average wagonload—which is, roughly, 5½ tons in this country, 25 tons in America, and nearly 9 tons in Prussia in pre-war days—by half a ton means a saving of nearly £5,000,000 per annum.

In the United States there are about 260,000 miles of railway, to which may be added about 145,000 miles of second, third, and other tracks, on all of which are about 2,350,000 freight cars (of much greater individual capacity than is customary abroad), 65,000 locomotives and 55,000 cars designed for passenger-train service—a scale of operations not to be found elsewhere. The whole railway problem of England or Germany or France is probably less than that of Illinois. The basis for making this statement is shown in the table below. Unfortunately, thoroughly satisfactory statistics covering the operation of railways in the various European countries are not available and certain gaps in this table can not be filled in. At first glance it will be noted that the mileage of track operated, the train-miles, and the locomotive-miles in Illinois are very low. On the other hand, the average number of net, or paying, tons of freight per trainload, as indicated above, was: United Kingdom, 134 tons; Prussia, 236 tons; United States, 533 tons. It would appear that Illinois compares with these European countries so far as ton-miles of freight carried is concerned. Although it appears that the figure for passenger-miles in Illinois is low it should be remembered that a very important number of the passengers carried in Europe travel in a manner resembling the service rendered by the

interurban electric railways in Illinois. Also, many passengers in Europe travel second or third class, while accommodations comparable to those of the American Pullman car are far less common in Europe than in Illinois. Remembering also that the railway problem of Illinois is complicated by an immense transcontinental traffic, that no city in Europe has a railway problem approaching that of Chicago, and that the winters in Illinois introduce difficulties not to be measured by mere statistics, it is felt that the following table proves the statement made above:

Items.	Illinois, 1911.	United Kingdom, 1913.	Germany, 1916.	France, 1913.
Area, square miles	56,665	121,439	208,825	207,129
Population (1910)	5,638,591	45,713,370	64,925,993	39,601,509
Total miles of line operated	22,366	55,405	55,108	36,844
Freight-train miles	46,191,042	161,684,409	165,779,876	90,607,165
Passenger-train miles	39,893,379	273,494,672	232,039,032	140,058,097
Number of passenger-miles	2,284,212,709	....	....	12,060,785,442
Number of freight ton-miles	19,497,923,096	....	....	17,730,490,092
Locomotive-miles	....	628,324,150	688,157,697	242,621,354
Number of passengers:				
Steam	84,584,001	1,591,146,000	....	547,885,773
Electric	245,504,925	....	....	....

There is every reason why, with the much larger scale of operations, American locomotive designs should be superior, and all the world concedes that we are a practical people. Whenever the returns are reduced to a "cost per ton-mile" basis, the advantages of American designs and American railway practice are obvious. In writing the above there is no desire to claim that the British or Germans or French or others do not make good locomotives, because it is well recognized that their products are good, but, on the other hand, there is no occasion to consider them superior to the American product.

REASONS FOR SUPERIORITY OF AMERICAN WORKMANSHIP.

The quantity production of interchangeable standardized parts is distinctly an American achievement and has had a most pronounced effect on a great deal of our machine design, especially of machine tools as used in the automobile, aircraft, munitions, and many other industries; and the principles involved are reflected in the interchangeability of parts of practically all types of machinery. Since about 1916 there has been much talk in England of adopting the same principles, especially in connection with munitions and automobiles; but when it is realized that the total British automobile production in any year never exceeded 70,000 cars (as compared with about 2,000,000 in the United States), even at times when there was a tremendous demand, it is recognized that the above production methods are scarcely understood or appreciated. Studies of the designs of the newer types of British machine tools as made by Engineering (London) are very interesting in this connection, and that magazine reached the conclusion[2] "that the British manufacturer has as yet touched little more than the fringe of mass production." Other European nationalities are in no better posi-

[2] Editorial in issue of Sept. 10, 1920.

tion. The significance of this is really very important, for it goes far toward silencing all the talk of superior European workmanship that we heard in former days. The European idea that accuracy can only be secured by hand fitting has often been forced to yield, especially during the war, to the American idea that interchangeability can not be secured when hand fitting is tolerated, and, further, American shops are prepared to produce economically and by standardized methods complicated parts within the narrowest of tolerances. A certain American manufacturer advertises that, with his type of lathe, duplicate parts can be turned out within a tolerance of one-thousandth of an inch, while another produces gauge blocks guaranteed to be accurate within 0.000025 inch per inch of length. The writer has seen in an American factory an automatic machine perform 22 operations on a machine part, all of which, in relation to every other, were held well within one-thousandth of an inch in repetition work. The methods involved in production along these lines are distinctly American. The finishing of products by these methods is greatly superior to the best "workmanship" found anywhere.

These production methods have had a pronounced effect upon the design and finish of practically all classes of American equipment, raising it to a level not known elsewhere. The particular ways in which these advantages appear differ among the different classes of equipment; but they should be emphasized abroad with all that they imply, including precision, uniformity, interchangeability, and the facilitating of repairs.

DEPENDABILITY OF AMERICAN MACHINERY.

Practically all machinery that is exported from America is of a design that has been thoroughly standardized to meet the requirements of the domestic market. These requirements are very severe, for in America the maximum is demanded. All machinery is required to show the utmost capacity, the utmost efficiency, and the utmost dependability—all to a degree not known abroad. In developing a standardized design to meet such conditions, sample machines are subjected to careful test both in laboratory and in service before approval. Frequently these tests cover not only working conditions but abnormal conditions, such as overload tests, endurance tests, and tests to destruction. From the circumstances of the case equal care can not be given to the nonstandardized equipment that is so often supplied from Europe, and as a consequence in the actual markets abroad one finds a thoroughness in the design of American equipment that is not equaled in machines from other countries. Naturally, in the absence of full data, nonstandardized designs are made heavy, but in foreign markets Americans will do well to discover when the "factor of safety" in competing equipment is really the "factor of ignorance."

Factory arrangement is also handled differently in America than elsewhere, and has been carried to a high degree of perfection. In cases where complete plants are sold this is a very important matter, for, under the American designs, plants are so arranged that the raw material passes into finished product with an absolute minimum of handling; fuel is economized by superior furnace and boiler design, and by reducing to the utmost piping and radiating

surfaces; superior illumination is obtained by eliminating belts and perfecting window and electrical arrangements. Foreign designs do not ordinarily show that these subjects have received the same thoughtful care—and they are all subjects that will bear much emphasis in sales work abroad.

Where American experts have been employed abroad they enjoy an excellent reputation. Frequently they have made successes where those from other countries have failed. In many of the communities of Asia they have established industries and are admired for the masterly way in which they have developed and continue to operate them.

Although it is not practical here to attempt to show the superiority of each particular design, it is safe to say in connection with all of them that in the individual machines, in plant assembly, in the pioneering of experts, and in their general activities American engineering and American engineers are equal or superior to the best. In his design the American displays a superior thoroughness and in his work a superior energy. These remarks are not offered for mere bombast. It should be emphasized in foreign sales work that Americans sell not only individual machines but also American engineering methods—the best that exist. And as they are little understood or appreciated abroad, they need to be advertised and explained correspondingly. Also, American products must usually be sold on a quality rather than a price basis, and such a sales organization must be developed as may be necessary to do this.

Previous to the war European machinery was offered on a price basis. There is some probability that a similar policy will be followed in the future. Sometimes electrical specifications were much less liberal than with us. Factors of safety in both strength and capacity were reduced, not as eliminating the "factor of ignorance," but as deliberate pinching and skimping even to approaching the unethical. On the other hand, European engineers can turn out good equipment when they desire to do so. The buyer's problem is to be sure that they do so desire. The American exporter should educate his customers in such a way that they will understand these matters clearly.

PROBLEMS CONFRONTING FOREIGN MANUFACTURERS OF MACHINERY.

It should also be remembered that a great many European shops are operating at a great disadvantage because the relative value of their labor and raw material has been most seriously changed since 1913. In the old days their designs and shop practices were based upon expensive materials and cheap labor. They were, and possibly still are, "tooled up" on this basis, but as a result of the experience of recent years all this has been changed. Their labor is no longer cheap, and this implies that their designs, their shop equipment, and, in fact, their whole organization are out of line with the times. It will be obvious to any production man that such a situation disorganizes the entire industry, making it necessary to revise designs, to "tool up" on the new basis, to increase the plant investment, and revise selling costs.

The Japanese and Chinese are also making efforts to supply machinery, but as yet their efforts are rather modest. The Chinese

produce machine tools, gasoline engines, semi-Diesel engines, and a few other similar products. The Japanese produce the above and also certain electrical equipment, such as wire, fixtures, fans, motors, transformers, generators, turbine sets and the like, textile machinery, grain-milling equipment, agricultural equipment, and pumps, as well as certain of the product needed for their merchant marine, army, and navy. The last-mentioned items need no further attention here. The other items are usually offered on a price basis and are rarely of satisfactory quality. Even so simple a product as plain copper wire is found to be unsatisfactory, failing frequently in service, presumably from inadequate annealing. Even copies of American designs are not up to standard. The writer has seen a milling machine that was made in China, copying a certain well-known American tool, but not a bit of surface on the whole machine had been ground or scraped. Such inferior goods are produced because of the high value of money in these markets. An American tool costs at least 50 per cent more in Asia than at the factory, and the buyer certainly finds it many times more difficult to raise a thousand dollars than does his American contemporary.

It is not accurate to speak of these products "competing" with those from America. They are in a different class. If a man can be satisfied with a bicycle it is not possible to sell him an automobile, or if he wants the latter he will not buy the former if he is an intelligent buyer. The American sales problem is to educate the buyers so that their selections may be made intelligently. The same remarks apply to European machinery. Only rarely does English or German machinery, or machine-shop equipment, or much else, really compete with the American product. The differences in design are too wide, often being fundamental, and in this the American manufacturer has the advantage, because the buyers want to buy intelligently if they can only learn to discriminate.

Possibly it is well to digress a little to consider the matter of copying. Many American manufacturers report that they avoid the Japanese market because after one sale they find their goods are copied. This policy is of doubtful value. In the first place, staying out of a market certainly does not bring in any business; and in the second place, such copies are in no sense duplicates. Only in the rarest instances is the quality satisfactory. Apart from everything else, there is not the same selection of materials. By looking at an automobile axle a Japanese or Chinese mechanic can not tell whether it is vanadium steel or .30 carbon. Even though labor in the Orient is cheap, it is desperately inefficient and lacking in dignity. Even though it be known that a certain piece of high-quality steel is needed for a certain job, there is a strong probability that it will not be available in their limited market. This subject has been well thrashed out in the Japanese trade, and the better class of Japanese buyers do not ordinarily buy Japanese machinery if it can be avoided. Most Americans should overlook this matter of copying.

With regard to the future the writer does not feel that either Japan or China shows any prospect of rapid development in machine building. Apart from what has been said about labor, the raw materials—coal, iron, etc.—are scarce and expensive, the selection of materials, knowledge of design, and shop practice inadequate, and

the matter of interchangeability of parts scarcely considered. Such experience as is so far available suggests that for equal quality the cost of the American product is in line, notwithstanding the import duty and other delivery charges.

On the other hand, British India offers a different situation. There the industrialists are just taking up the production of machinery. The problem is being approached in a very different way. In the Tata Steel Works and other plants they seem to have sources of supply for pig iron and a few grades of steel at attractive prices. The policy of local manufacture has strong Government support. An effort is being made to put the work in the hands of qualified and competent men, with a certain amount of cooperation with European manufacturers. It remains for the future to demonstrate the outcome.

REASONS FOR SUPERIORITY OF AMERICAN RAW MATERIALS.

Another point of view illustrating the superior position of the American machinery industry is developed when we consider the raw materials, iron and steel (copper might also be considered), available in each of the different countries. The peace treaty leaves the United Kingdom, France, and Germany producing nearly equal quantities, while the United States produces nearly as much as the other three combined. This preponderance has had a very beneficial effect upon the development and production of machinery in the United States, and its influence will become increasingly important hereafter. Germany has lost an important fraction of its former supply, and this must prove a handicap. Also, Germany and the United Kingdom have shown us what we may expect from them. But the genius of France remains to manifest itself. For the first time France has an equal (or possibly superior) supply of raw materials. New development must follow. French engineers are very capable, as has been shown in artillery, automobiles, aircraft, and many other ways. France starts afresh, without much in the way of semiobsolete equipment. Munitions production during the war has given it the opportunity to learn all that America had to teach in connection with standardized production within narrow tolerances. It has imported very large quantities of machine tools from America, being at times our best customer along these lines, and it may easily happen that in a few years France will be more important in the machinery markets of the world than either the United Kingdom or Germany.

The outstanding element in all discussions of Japanese or Chinese "competition" is the cheapness of oriental labor. Recently one of the Japanese shipyards considered the project of manufacturing automobiles and, after studying the subject, their engineer is reported to have announced that the "low cost of labor will not offset the efficiency of the skilled American workman." "Even with the highest type of automatic machinery" he doubts "whether equal results could be obtained."

"UNIVERSALITY" VERSUS SPECIALIZATION.

The only country in the world that exports machinery in amounts that are at all comparable with those from the United States is the United Kingdom. On subsequent pages of this report will be found

details as to the kinds and quantities of equipment that this country sends to each of the countries visited by the writer. It will be noted that very frequently the British and American lines are scarcely competitive. Recent reports suggest that comparatively few British machine-tool builders have profited by their experience during the war. Many are continuing their pre-war methods. The difference in quality between British and American machinery is suggested by the following imports into England of American "metal-working machinery": 1910, $1,362,965; 1913, $3,417,655; 1915, $12,294,801; 1918, $19,296,903; 1919, $15,221,946; 1920, $11,135,567. If the British product is really competitive, how are these shipments to be accounted for? The war does not explain the earlier and later shipments. A similar argument could be advanced with regard to other classes of machinery—mining machinery, textile machinery, electrical machinery, and a number of other lines. The trend of British machine-tool design is toward universality—one tool for many tasks—while the trend in America is toward specialization, single-purpose machines. It becomes a question as to the extent to which each type of equipment is needed in the markets of Asia. It is also a matter of salesmanship to demonstrate the possibilities of the higher-priced, high-production, accurate American tool. It should also be added that there seems to be some question as to whether British-made tools show the accuracy of the American products.

The American position in the world's machinery markets is distinctive and peculiar. It is sometimes said that we should sell a man what he wants, which may be all right if he wants the right thing, but because he so often thinks he wants the *cheap* thing the case usually requires more salesmanship than the above policy suggests. Because of the high degree of standardization adopted in America it is often impractical to supply the special article. Few buyers in Asia have any adequate idea of the costs involved in little special details. To finish an order of five sizes of electric motors in green where the standard is black involves trouble and expense that is out of all proportion to its apparent importance. Other nationals are confronted with this same problem, as is shown by the following quotation from a British writer:[3]

> A great deal has been said about the German manufacturer and merchant being more inclined to study and deliver the exact requirements of foreign markets than his British counterpart. This charge against the British manufacturer is, for the most part, wholly false and, in the writer's opinion, has its origin in the fact that Germany has at home a bigger house industry as opposed to our bigger factory industry. It can easily be seen that when a German toy dealer was asked to supply 10,000 boxes of tin soldiers in khaki instead of scarlet uniform, all he had to do was to buy khaki instead of scarlet paint, give out so much paint and so many soldiers to each family round about and deliver the goods as required. As opposed to this, let us suppose that a Yorkshire manufacturer receives an order for 10,000 pieces of woolen cloth, with the stipulation that it is to be made 4 inches wider than before; very probably he would have to buy and install new looms to make this extra width of cloth, and he would likely enough have to refer the order back with the information that he could not execute it unless given a very long time and a very much higher price. This is undoubtedly the explanation of the bad reputation we have given ourselves. The writer has had many opportunities of putting new and strange requests before both British and German manufacturers, and can not recollect a single instance in which a British manufacturer showed un-

[3] From the very interesting booklet "British versus Germans in China," by Dennis K. Moss, published by the Hongkong Daily Press, 1917.

willingness to do all in his power and reason to meet new conditions or manufacture articles specially designed to meet Chinese tastes. And the same can be said for the German manufacturer. We produce and export to all countries in the world many articles of such excellent quality and standardization that it would be a crime to change them in order to gratify the changing whims of fashion in many parts of the world. The Germans have also a smaller number of such standard and typical products. One can not imagine that the distiller of the well known "4711" brand of eau de cologne would be willing to change his famous quality number because the digits add up to the unlucky number 13, but similar requests are made daily and for simillar and most trivial reasons. Owing to the superior and standard quality of many British productions the British producer is often unjustly blamed for his refusal to cut his own head off.

These same remarks apply to American machinery with considerably greater force, as these products are usually of manifest superiority and are much more highly standardized than is the case with foreign equipment.

FOREIGN COMPETITION AS AN ASSET.

But it should also be realized that foreign competition is helpful as well as hostile, and it is well to meet it in a cordial and friendly spirit. This attitude is shown in the following quotation from a British author, with most of which the present writer heartily agrees. It is taken from "The British in China and Far Eastern Trade," by C. A. Middleton Smith:

> American competition will help us. Our Anglo-Saxon trade rivals work well with us in China. They do good pioneer work. They show us how to "push" things, but they will forgive an admirer for reminding them that they have not had the experience in trade or in engineering (*sic*) that the Briton has had. But they will be with us in the maintenance of the ideals of our profession. Their technical goods may be less finished than ours, but they do not disgrace the reputation of engineering work. Americans give me the impression that they expect much bigger profits on their capital outlay than do the British. Wherever they go they spread the gospel of the English language and the "get-on-with-it" point of view. They have made up their minds to get into this market, but there is any amount of room for them and for us. It is absurd to suppose that they can drive us out. We may slip off the car because we are asleep, but they will never push us off. It is right to add that usually they are more popular with the Chinese because they are rather less of what they call "the high-brow" type than the average Briton. They do not hesitate to mix freely with the Chinese. We suffer just a little in China from the traditions of the Anglo-Indians.

GENERAL NATURE OF THE SALES PROBLEM.

Foreign visitors to the United States are usually tremendously impressed by the extent of our mechanical development, and this applies to an endless variety of industries. Our railways are far in advance of those of every other country, our skyscrapers and their mechanical equipment are greatly superior to anything of their class to be found abroad; our steel production is some 40 to 50 per cent of that for the entire world and, with our high-priced labor, is only maintained on a competitive basis by the superiority of the mechanical equipment used in the whole process from ore and coal mine to finished product; the precision of our standardized production is unsurpassed; the ingenuity of our automatic machinery, from watch-factory equipment to printing press, is generally recognized to be unknown elsewhere. Whenever one can get a frankly impartial statement from qualified foreigners, the superiority of American machinery, American processes, and American engineering is usually

readily conceded. This, after all, is only to be expected when it is realized that we have the necessary materials in abundance, that our operations are conducted on a larger scale than those in other countries, and that the wage paid labor is very high. Under these conditions it is obvious that the machinery produced must be of high quality and of highly standardized types and must be sold at a high price. This means that when it is offered in the open markets of the world it can be sold successfully only if the campaign is supported by adequate salesmanship and advertising. Fortunately this is not so difficult as the bare statement might suggest—as is demonstrated by the successes of many American manufacturers—but it does indicate the nature of the organization required.

SUCCESS OF AMERICANS IN EXPORT TRADE.

During recent years there has been a tendency on the part of certain people to claim that Americans are new to export trade and, being new, are not able to handle such business on proper lines. There has been a similar disposition to claim that America is new to the business of shipping and can not make a success of it, and these arguments have formed the basis of a hostile propaganda in certain places. At the same time it has been customary to make correspondingly flattering statements about the businesslike ways and wonderful successes of the representatives of Great Britain and Germany. But the facts do not support such claims. Long before the Franco-Prussian War, before Germany had a merchant marine of consequence or had developed its present industrial system, American foreign trade was of very serious importance and world-wide. American ships were trading in all the important markets, and their business and prestige grew until even the British found the competition most "salutary." The situation in the China trade of that time is described by a well-known British writer as follows:

> Larger and finer ships were constantly being added to the American fleet, until they almost monopolized the trade not only between New York and San Francisco but also between China and Great Britain. British shipping was, in fact, reduced to the greatest depression, the falling off in the supply of new tonnage being almost commensurate with the increase of that of the United States.[4]

Elsewhere, referring to the wonderful tea clippers that raced from China to London at the beginning of the season each year, the same author writes:

> For the beginnings of that struggle we have to go back to the year 1851, when the Leith clipper *Ganges* raced two Americans, the *Flying Cloud* and the *Bald Eagle*, from China to London, finishing up with an interesting tack-and-tack contest up the Channel from Weymouth, the English ship passing Dungeness six hours ahead. At that period the odds in numbers were so overwhelmingly against the English vessels that such occasional victories as the above were calculated to inspire the builders with courage to persevere.[5]

The history of American foreign trade and the American merchant marine of that day is a thrilling story of the successes of the enterprising pioneers. But the merchant marine fell from its premier position, not because of any inaptness of the American people but as incidents of the privateering during the Civil War, as, for in-

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[4] "The Englishman in China," by Alexander Mitchie, vol. 1, p. 230, published in 1900 by William Blackwood & Sons, London.
[5] "The Englishman in China," vol. 1, p. 240.

stance, the well-known case of the *Alabama*, coupled with the change from wood to steel and sail to steam vessels. But this does not imply that American foreign trade dwindled, for the United States has been an important exporting Nation for decades, the comparative importance being shown by the following returns for 1913, computed at par of exchange: United States exports, $2,465,884,149; British exports, $2,552,692,105; German exports, $2,403,311,000. Obviously, Americans are and have long been genuinely successful in foreign trade.

Furthermore, those companies that have the most perfect organization for world-wide trade are, to a large degree, American, and their activities date back many years. The showing of Americans in international trade is one of which we can be very proud.

AMERICAN POSITION AS SHOWN BY MACHINE-TOOL EXPERIENCE.

If desirable this subject can be narrowed down to the machinery field. On page 23 is a statement showing American exports of metal-working machinery to the United Kingdom. In the chart on page 27 is shown the record of the exports of metal-working machinery since 1909, from which it will be noted that even before the war American exports were increasing far more rapidly than either the British or German. Subsequent experience requires no comment, but it should be noted that the values indicated for the German trade are deceptive because they are too large. The German classification includes a number of kinds of equipment not included by the others. The significant factor in a diagram of this sort is not the value indicated but the slope of the curves.

The relative position of the three countries in the world's markets is shown by an investigation made in South America in 1915,[6] which showed that there were then 461 machine shops in 12 Latin American countries. About 70 per cent of these plants were visited, including all of the larger shops. In the plants visited the following tools were found:

Lathes	3,417
Planers	885
Milling machines	425
Boring	522
Drilling	1,695
Grinders	997
Various (including wood-working)	3,740
Total	11,681

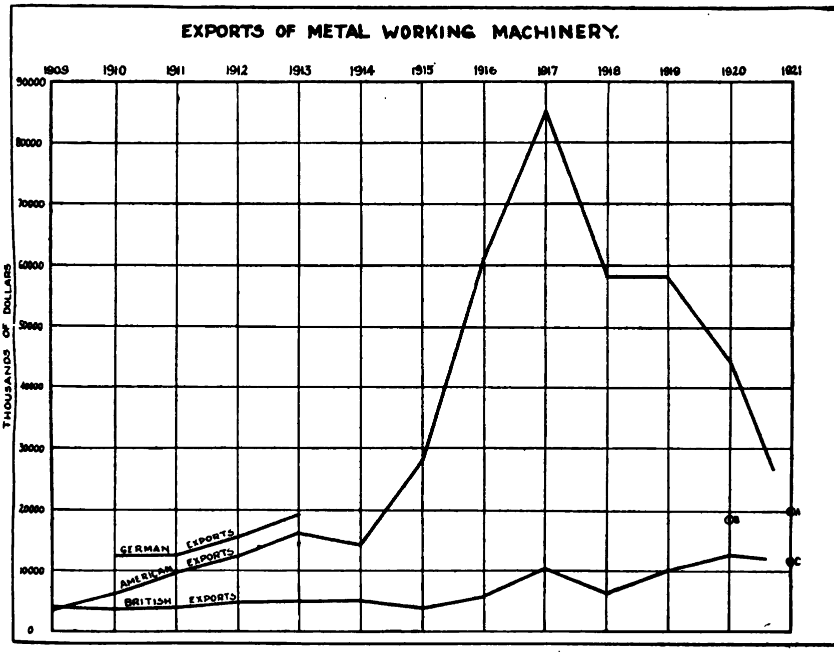
The nationality of these tools was found to be as follows:

	Per cent.
British	43.2
United States	39.3
German	13.4
French	3.2
Belgian	.5
All others	.4
	100.0

It should be remembered, as has been stated on page 11, that Germany sold more factory machinery in pre-war days in Latin America

[6] Made by Duncan M. Hood, of the McGraw-Hill Co. See American Machinist, April 20, 1916, p. 697.

than in Africa, Asia, and Australia put together, but regardless of its reputation as a factor in international trade and its special financial arrangements, Germany only managed to do about one-third as much metal-working machinery business as either the United Kingdom or the United States, and about one-eighth of the total—a showing that is a wonderful testimonial to the merits of American-made machine tools when one remembers the inadequate sales effort supporting them.



A—ESTIMATED AMERICAN TOTAL FOR 1921
B—ESTIMATED GERMAN TOTAL FOR 1920
C—ESTIMATED BRITISH TOTAL FOR 1921

FIG. 3.

British participation in this business at that time was not an expression of the price or engineering merit of the machines. To use the words of the American Machinist:

> The reason for the predominance of British-made machines is undoubtedly found in the financial arrangements that have existed between South American countries and English capitalists. British gold has financed South American railroads, mines, and other enterprises. Many of these projects have been organized and operated by British engineers. It was very natural, therefore, that they should buy British machinery. * * * It is evident that there is nothing disheartening to American machine-tool builders in these statistics.

The position of the British machine tool in post-armistice foreign trade is shown further by the diagram in Figure 4, from which it will be noted that as late as August, 1920, or 22 months after the armistice, the United Kingdom still imported a greater value of machine tools than it exported. These imports were largely from the United States, and this patronage testifies to the superior qualities of the American product. The downward slope of the curve, repre-

senting imports, indicates the business situation then existing, and it will be noted that British export experience was similar after December, 1920.

The American machine tool is a very high-class product and leads the world, being superior to all others. Other classes of American machinery also occupy a similar position. To a very great degree there is no real competition for American machinery, but it *does* need to have better representation in foreign markets. Interested manufacturers should devote much more attention to their foreign sales. It should also be recognized that our country is very large and contains an element that has had no adequate experience in export business. During the years when the market was so abnormal—when it was a "sellers' market"—this class entered into foreign trade

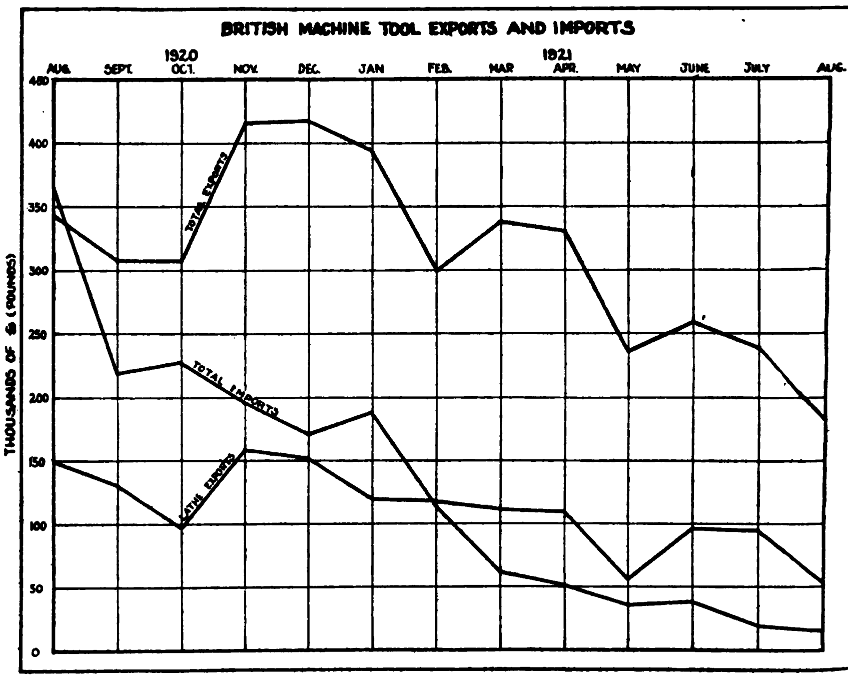


Fig. 4.

with results that have been so unfortunate as to become conspicuous. It is not necessary to elaborate on this subject. The conclusion is obvious. There is no substitute for knowledge. Organization plans and methods which it has taken the competent exporter years to work out and develop through patient effort can not be duplicated overnight. Concerns with a scant knowledge of the intricacies and variations of foreign trade will only develop a satisfactory business by adopting the same painstaking methods. Those who will succeed are those with knowledge, experience, and business judgment. In planning for foreign trade it is necessary to follow sane, sound business methods established on a scientific basis and developed with clear thinking. But there are most promising opportunities abroad for those who will consistently pursue these methods.

EFFECTIVE MEANS OF PROMOTING MACHINERY SALES IN ASIA.

FUNDAMENTAL FACTORS TO BE CONSIDERED.

In preceding paragraphs it has been demonstrated that the American problem in developing a campaign for greater machinery sales in Asia is that of marketing standardized products of superior quality and relatively high price in competition (if that word is appropriate) with the products from the shops in other nations, where ordinarily designs have not been given the same thoughtful care, materials are not selected with such good judgment or else are not obtainable, and workmanship, especially if judged by the standards of accuracy and interchangeability as distinguished from paint and unnecessary polish, is not so good. Obviously such a sales problem involves the application of superior salesmanship backed by an appropriate organization. It also introduces the problem of advertising, which can be employed effectively in many instances.

No campaign for foreign business should be started until the necessary domestic organization has been developed. Instances have been known where firms have actively advertised in foreign countries and later, when confronted with an export order, did not know how to execute it. Such methods are inexcusable and discredit the manufacturer at home and abroad. Export business is good business and worth sustained effort. Some large American firms depend almost entirely upon their foreign business. It has been shown that the average American machinery manufacturer exports 17 per cent of his product. Also, this business can be secured on terms that are clean and attractive, but to sell without proper preparation is but to sell trouble.

Neglect of foreign customers, bungling methods, in fact, all of the long list of export sins accumulate "bad will" against the day when a serious effort is to be made. Also, these failures create a handicap for other Americans who are overseas. Manufacturers should keep out of foreign trade until prepared to handle it properly. These remarks should not be interpreted to mean that foreign trade is difficult, for, properly approached, it is easily handled and clean business and Americans can handle the trade as well as anyone else, as is demonstrated by the volume of machinery sales, totaling nearly $400,000,000 in 1920, as shown on page 2.

While it is possible to imagine any number of different forms of organization that might be employed in the sale of American machinery in these markets, the problem is really very simple, for all industrial machinery sold in Asia, whether American or European or of other types, is sold through the machinery dealers that are established in each of the Asiatic cities and that act as import merchants there. It is true that in some of these Asiatic markets offices will be found bearing the names of well-known European or American manufacturers of machinery—as, for example, Fraser &

Chalmers, in Singapore—but in every case it will be found that these companies act as agents for a number of other manufacturers, thereby becoming in reality merchants, as distinguished from the branch offices of manufacturers, as known in the United States. Even in those cases where the manufacturer's name is used abroad, the branch is frequently a separate corporation. The fact remains that the system of selling machinery through merchants is the only one that has been found a marked success in the sale of factory machinery in Asia.

As has been explained in "Selling in Foreign Markets," it is most important that a definite foreign sales policy be established. This policy may be different for the differing conditions of varying territories, but for each case it should be definitely decided whether the manufacturer will quote only f. o. b. works or f. a. s. New York (or equal) or c. i. f. destination; whether he will open a branch, send his own salesman, grant an exclusive agency, or operate in an open market, etc.

In order to employ genuinely constructive salesmanship the best method, in Asia, is to arrange an exclusive agency for each particular market, at the same time arranging to have the agent employ a sales engineer who has been trained by the manufacturer. Where this is not practicable the next best plan is to make a similar arrangement where the salesman has been trained by another firm. Beyond this there are many other plans that may be followed, but they all depend upon the careful selection of an agent.

SELECTION OF AN AGENT.

Unquestionably the best way to select an agent is to gather all possible information in America and then visit the ports of Asia, investigating the matter and coming to an agreement on the spot. When conditions justify, this should be done, but, if attempted, it should be done properly. It requires about 17 days and, say, $350 to cross the Pacific Ocean, and expenses will be not less than $10 per day for the barest necessities afterwards. Most executives will spend between $15 and $20 per day. Conditions in the Orient are very different from those in the Occident, and it is a great mistake to feel that it is possible to rush in, acquire the necessary information, make a decision, and hurry on in a short time. Furthermore, each country has its own peculiarities, so that it is scarcely safe to draw conclusions from one with respect to another. Each constitutes a separate sales problem and deserves a careful study.

The trip abroad gives most valuable opportunities for establishing friendly connections and learning market conditions. When conditions prevent the executive from making such a trip, sometimes it is wise to send a substitute if a qualified man is available. In any case, this method of selecting foreign representatives is the most satisfactory, and when the circumstances justify it should be employed.

On the other hand, it is expensive in time and money. As is suggested by the map opposite page 1 such a trip from Yokohama to Bombay would require from six months to a year and would cost several thousand dollars. Many manufacturers have been able to establish a good series of agencies by correspondence and by ne-

FIG. 5.—OKURA & CO., TOKYO.

FIG. 6.—MITSUI BUSSAN KAISHA, KOBE.

FIG. 7.—HORNE CO., OSAKA.

FIG. 8.—ALEX ROSS & CO., HONGKONG.

gotiating with the American offices of eligible export firms. Lists of the machinery dealers in the various cities of Asia that should be valuable for the above purposes can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., upon application. The bureau has a very good collection of such information covering the entire world. When circumstances make it at all practicable, the best results will be obtained by a personal visit to the bureau, as a great deal of information is collected there regarding the qualifications and limitations of these dealers which it is not practicable to issue through the mails. The commercial library in the Department of Commerce is one of the best in the world. It is remarkable what a wealth of information can be collected in this manner. Also, in addition to the above sources, further information regarding these dealers can be obtained through the consuls, commercial attachés, and trade commissioners who are maintained in these foreign countries by the Government and who will gladly answer specific requests for information. These reports can be verified and credit information secured through the banks and credit bureaus. In some cases the various manufacturers' associations can assist. Business friends can often be helpful.

Ordinarily the idea of granting an exclusive agency agreement is to stimulate the merchant to creative, constructive sales effort, thereby adding to the profits of both manufacturer and agent. If business is not stimulated the arrangement is a failure. To make a success, an agent first of all needs to have an organization for and an interest in the sale of machinery, and he must be in a position to cover the entire territory under consideration. He should have his engineering department in the hands of qualified engineers who understand the class of machinery involved and the country in which they are to work.

The matter of covering the territory adequately is very important. Many of our people use the political boundaries, thinking that they mark out the business districts. This is a great, though common, mistake. The fact that a firm has an office in Shanghai is no proof that it can cover properly the Hongkong or the Peking districts. In point of time Peking is as far from Shanghai as Salt Lake City is from New York. Very often a Calcutta firm is not prepared to cover either Burma or Bombay.

There is, one need scarcely say, a great difference in firms. To a remarkable degree they each develop a bent for a certain kind of trade. Each has its own business methods, its special clientele, and a certain line of work that commands its attention, and it will prove correspondingly more or less valuable in selling a given commodity. Unless elaborately organized, if a given firm specializes in machine tools, it will give inferior results in the sale of textile machinery or ice plants. The direction of this bent can often be discerned from a study of the list of its agencies (often in the hands of the Bureau of Foreign and Domestic Commerce). From time to time these firms may discover special opportunities because of which they may want what might be called an "outside agency," but the interests of the manufacturer lie with the man who will give his line consecutive sales effort.

Similarly, from a list of agencies it may be possible to make sure that the candidate does not already represent competing equipment.

Agents do not always act in good faith. As has been pointed out in "Selling in Foreign Markets," agency agreements are sometimes solicited in order that the manufacturer's sales efforts may be throttled.

Under other circumstances an agent may be so placed as to be peculiarly fitted to market a given line of machinery. One already well established in the sale of textile machinery would be in a good position to sell humidifying equipment. A dealer who is well established in the sale of pumping machinery would probably be in a position to handle filters and water softeners to advantage. One who has a reputation for selling machine tools would be in a position to market files.

With a little effort it will ordinarily be possible to collect a good deal of information about a prospective agent, not only along the lines already suggested but also with regard to his moral and financial qualifications, and such effort will usually be well rewarded. In general these merchant firms and the men employed by them are of a very high class. The larger of these companies are strong enterprises, doing a very large business of many kinds and supported with ample capital, owning a great variety of important properties and with a name that represents a very substantial good will. In the more important cities these firms are established in well-built office buildings, with all modern improvements, that are sometimes of very pleasing appearance and occidental in style. In the smaller or less important cities these merchants are housed in less pretentious buildings and have a smaller staff, but ordinarily will employ the same general business policies.

In these same cities, large and small, are other companies engaging in the same class of business, but not so well equipped as regards resources, personnel, or good will. These smaller companies often present a good appearance on a letterhead or in a directory. In some instances they specialize in a definite way and for such trade are very useful. In other instances they employ men of limited ability and experience and poor business methods, with results that are far from satisfactory.

PLACING A SALESMAN IN THE FOREIGN OFFICE OF THE AGENT.

When arranging for the appointment of an agent the manufacturer should also arrange for such supervision of this agent as is necessary to protect and promote the interests of the manufacturer. There are many ways by which this can be done. More and more the better merchants and manufacturers are arranging to have a qualified salesman (really sales manager) join the staff of the agent in each imporant foreign office. The details of the arrangement vary a great deal, but the plan is very effective where circumstances make it practical, and it overcomes many difficulties. An alternative method is to have this man travel to supervise a number of offices—an arrangement that has been used a good deal in the automobile trade.

If a man is to be sent abroad, extreme care should be exercised in making the selection. "Records of American concerns with interests in Buenos Aires, for instance, show that, of the men sent from the United States during the last four years to that city (one of the most attractive spots in South America), over 80 per cent returned, or

were returned, home inside of 12 months."[1] A good man can accomplish a great deal. A poor selection is very expensive, not only because of the way the representative spends money but also in the effect upon the reputation of his company. The man should be one with a fine sense of the better things in life and of demonstrated integrity. "Capitalists, as a rule, do not intrust their interests abroad to persons without character. The character of their representatives abroad is even more important than the character of their representatives at home, because a larger responsibility rests on those who serve them abroad."[2] "Many American firms make the mistake of thinking that they can establish a permanent business by sending to South America the well-known 'rough and ready' type of American salesman, who wears his hat and smokes a cigar in his customer's office and who has no interest beyond sending in orders. These men often get an initial order, but the business is apt to end there. The South American does not do business that way."[3]

In Asia a special representative of a manufacturer occupies a position of real importance, corresponding somewhat to that of a branch-office manager at home, except that he has greater responsibilities. He is in competition with the whole world. He is thrown into intimate contact with Europeans and Asiatics of all sorts and must maintain his position and adequately represent the interests of his principals at all times. He must be equal to any emergency. If anyone makes a mistake, whether in the home office, in the factory, or on the 10,000-mile line to the ultimate buyer, this man must "absorb the shock," rise above all complications, and handle the matter in a creditable way. He is a "business ambassador" and should not be sent unless he knows his business, his line, and is loyal to the interests of his principals, with confidence in their products and organization. Without full confidence satisfactory results can not be secured. Unless the manufacturer has full confidence in the representative he should not be selected or sent; unless the representative has full confidence in his principals he should decline to go, because in Asia he will meet endless difficulties in the day's work. An exchange of letters will require two or three months; cables are very costly and often mutilated. Lost orders, sacrifices in commissions, heat, discomforts, disease, and a thousand other annoyances tend to undermine one's determination, and real stamina will be needed.

This man should be intensely American. While this requirement has always existed, it has recently become of increased importance. Although the writer feels that it is unfortunate that nationalism is emphasized abroad, the fact remains that Europeans do so emphasize it that it is not at all uncommon to find men in important positions who look at the matter from a very narrow piont of view. The American engineering salesman abroad sells more than an individual machine or even a complete factory. He sells the American way of doing things; his machines will not prove to be a real success unless they are operated in the American way, and the American way differs from the European or Asiatic way. Of what value is automatic machinery unless it produces a standardized product? Why have a

[1] "Selling in Foreign Markets," p. 288.
[2] "American Foreign Trade," p. 296.
[3] Wall Street Journal. See also Commerce Reports for Aug. 28, 1922.

standardized product unless interchangeability is important? Through quantity production, inventiveness, and clear thinking American engineering has been raised to a position that is in advance of all others, and it requires men who are thoroughly familiar with these American methods and ideas to properly represent American goods abroad.

FOREIGNERS AS AGENTS.

This suggests that it is not usually advisable to grant agencies to foreign firms. Experience shows that this is somewhat dangerous. Entirely apart from those who deliberately act in bad faith, it is very seldom that foreigners sufficiently appreciate the merits of American designs to represent them properly. They do not adequately understand American ideas of economy of labor, speed in production, standardization of method as well as product—in short, the work of a production man. Their sales and advertising methods differ from those followed by Americans, making it difficult to link up the foreign office plans with those of the home office. These remarks apply with peculiar force in English-speaking countries.

In territories where sales are to be made to those unfamiliar with English, good results can sometimes be secured through foreign representation, not because the above remarks do not apply but because it is difficult to find Americans who are sufficiently familiar with the foreign language and ideas. In Japan a Japanese firm undoubtedly has certain advantages in the appeal it can make to persons of that nationality. In Java the Dutch have a similar advantage. But even under these favorable circumstances it will be found difficult to Americanize the sales campaign. In selling engineering equipment in these markets the salesman sells American ideas as much as he sells American machinery. The outstanding problem in working through these foreign firms will be to convince the ultimate buyer of the superiority of the American method—to arrange for one Japanese to persuade another Japanese to adopt American methods in his shop, or to manage so that one Hollander persuades another Hollander to adopt American practices. It is always very desirable to arrange to have the agent employ a good American salesman, preferably one who has been trained in the plant of the manufacturer.

COST OF LIVING IN ASIA.

From what has been said above it is clear that the man needed abroad is a superior type of engineer with a really good commercial instinct, who has moral qualities that will surmount the temptations of the East and social qualities that will make him persona grata with all the world. Such a man has qualifications considerably above those of the ordinary domestic salesman and can command a good salary at home. His standard of living in Asia is necessarily high. In his home he will have from 3 servants or more in Japan to 5 or more in China and not improbably 17 in India. Much of what he eats and all that he wears is imported, as are also his medicines and luxuries. His doctors, dentists, and entertainment are very expensive. His membership in various clubs will cost from $150 to $400 per year, according to circumstances. If he has children their

education is a very serious problem and is expensive, and if they are to have university training at home (as their father undoubtedly had) much costly traveling is involved. In addition to all this (which deserves a good deal of sympathetic consideration) the man must feel some inducement to keep him abroad. No such man wants to "lose touch" and fossilize on forgotten shores in Asia, and ordinarily will not be satisfied to remain abroad unless he can show a substantial net saving each year.

The salary paid must allow for the cost of living at the standard usual in Asia, and this can not be compared to conditions in America. In India, as has been stated, a man maintaining a home corresponding to that of an average professional man in America will probably require 17 servants. In this country it is difficult to keep one. In America an automobile probably would not be considered a necessity, but in Toyko, Shanghai, Manila, and most of the eastern cities it is really needed. This subject is so complicated and at the same time so important that a number of investigations regarding it have been made at different times. Also, the cost of living is rising so rapidly all over Asia that the matter needs to be reviewed frequently.

In order to emphasize the variation in the cost of living in the different cities of Asia, it is well to summarize certain totals (of monthly expenses) appearing in the journal of the British Chamber of Commerce of Shanghai:

Localities.	Young bachelor.			Young married couple.		
	"Mess."	Boarding house.	Hotel.	Rented house.	Boarding house.	Hotel.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Burma	30 5 5⅝	30 11 11¾	34 16 7⅜	79 17 7⅞	63 16 ½	73 4 10⅛
Shanghai	39 15 10	42 18 7	63 4 4	85 14 7	72 7 7	111 0 0
Tientsin	47 7 7	42 16 0	48 8 1	102 17 7	88 1 9	102 14 9
Hongkong	37 0 10	40 6 3	60 5 10	78 0 1	67 0 3	105 15 2

Fuel has been included in the Tientsin figures and omitted from the Shanghai table. Telephone, medical attendance, and contingencies are excluded. Also, this represents the standard of living of those in subordinate positions. An interesting contrast appears in the figures for a young married couple in a rented house when it is assumed that the man holds a position of responsibility and that there are children 7 and 9 years old; their minimum net expenses are calculated at $1,146.70 Mex. per month.

In Japan the cost of living is higher than in Shanghai. A somewhat similar investigation made by some business men in Tokyo showed that a married man without children, in a position carrying no social responsibility whatever, as for instance one sent to supervise the erection of a plant, could not possibly get along on less than 800 yen (practicaly $400) per month.

COST OF OPENING A BRANCH OFFICE.

In view of the cost, only a limited number of manufacturers will feel that they are justified in sending one of their own men abroad to handle their own line exclusively at the manufacturer's expense. Fewer still will be in a position to open up a branch office.

Rent in a modern-style office building in Tokyo, with steam heat and electric light, costs from $1.50 to $3 per square yard per month, according to conveniences and location. Japanese old-style buildings with no heat or light and very indifferent conveniences can be secured as low as $0.60 per square yard per month, or, say, $35 per month, for a small office of two or three rooms. A Japanese salesman will cost about $150 per month and, in addition, will need the incentive of about 1 per cent commission on his sales. A European stenographer can be secured for about $150 per month. Japanese stenographers can be secured at from $75 to $150 per month, according to ability. A typist, incapable of shorthand, will expect $50 per month or more. A girl to carry messages is paid $15 to $20 per month. To operate an automobile costs about $125 per month, exclusive of depreciation and the more expensive repairs. The chauffeur is paid about $40 per month. On graduation from engineering school the young engineer starts his career at about $75 per month. The office boy without unusual education starts at $7.50 per month, minimum. When he is promoted to elementary desk work he gets about $12.50 to $15. A tally clerk, checking goods into and out of warehouse, is paid $37.50 to $50 per month. These were the rates paid in 1920, but they are rising rapidly.

RAPID INCREASE IN EXPENSES.

These figures are presented in an effort to show the true position as it is now in Asia, because experience shows that the situation is not well understood. Prior to 1900 living there was cheap. A tourist could have a most enjoyable time at very modest expense, and the world still seems to feel that the conditions of the last century continue to exist. That is where many have made serious mistakes. Among Asiatics the standard of living is rising rapidly, and life there has become very expensive. Japan is now one of the most expensive countries in the world—a fact that is having a serious effect on its foreign trade. Living in China is also costly, but less so than in Japan. India and Java are no longer cheap. In all of these places hotel bills will approximate $8 to $10 per day, American plan.

Because of the costliness of maintaining direct representatives, most American manufacturers of machinery will secure the best results by making an agency arrangement with one of the machinery dealers (importing merchants) in each of the more important of these Asiatic cities, and this appears to be the most successful method followed not only by American producers but by British, German, Swedish, and other producers also. Even the largest of our manufacturers—firms that export from $1,000,000 to $3,000,000 worth of machinery per month, firms that export 60 per cent of their production—have agency arrangements with these machinery importers in the various cities of Asia and, when necessary, send experts to cooperate with the merchants.

Before leaving the subject of agents and salesmen abroad we should refer to those firms that are disinclined to appoint an agent of any kind anywhere. There is nothing constructive in such a policy. It is absolutely without method. If the product has high inherent merit it may " sell itself " for a time, the result being a more or less unseemly scramble for the business on the part of the merchants, but no one has any inducement to maintain the market and ultimately

it will probably fail from a variety of causes. Although it is expensive to live in Asia, the merchants there more than justify themselves. The best plan is to work through these merchants and as constructively as possible.

RELATION OF MACHINERY EXPORTS TO CAPITAL EXPORTS.

There are other ways of promoting machinery sales in Asia to which our manufacturers should give careful thought. Until about 1916 the United States was a debtor nation and invested practically no money abroad, but did pay Europe perhaps $500,000,000 per year in interest. Since we became a creditor nation conditions have become a little confused, but our growth has been very rapid and it seems safe to conclude that we have at least $1,000,000,000 per year available for foreign loans. During both 1920 and 1921 several hundred million dollars were actually placed in such loans through the New York market; 1922 and subsequent years will show a much larger business of this sort than appeared in 1920. Heretofore these have been to a very large extent unrestricted loans to governments. On the other hand, such capital can be so placed as to be of much greater value to American interests. The situation is illustrated by a paragraph that appeared in an English technical paper:

> In the past, British municipalities have borrowed hundreds of thousands of pounds to build a power plant or a waterworks, and have then placed contracts for the whole of the machinery with foreign countries. * * * In connection with the development of the power supply of the Rand at Johannesburg something like £2,000,000 was borrowed in London for this purpose, and practically the whole of the machinery purchased with this money was procured from Germany.[4]

In connection with loans made for railways in China, and other enterprises elsewhere, European agreements have often stipulated that equipment should be purchased from the country supplying the funds. "All material used for the execution of this work not already in the country will have to be of French origin and transported on ships flying the French flag" is the provision in connection with a French loan for a railway in Indo-China. The effect of large transactions on international exchange rates may be very serious and neutralize the profits from the loan. To use the words of a recent writer on foreign trade: "The new era is essentially the era of the trade that follows foreign investments. The prime need, therefore, in order to secure a large volume of new business in South America is for the United States to export some of its capital as well as its products."[5] The situation in Canada has recently been such that manufacturers establishing branches there could gain as much as 15 per cent profit through exchange on funds remitted for construction and other work there, and it is estimated that there are more than 600 American-owned plants now in Canada—an arrangement that operates to the advantage of both countries. The Monetary Times of Canada recently drew attention to the fact that about $1,000,000,000 of American capital had been invested in Canada during the last five years, thus going far to correct the trade

[4] London "Engineering," July 2, 1920.

[5] "American Foreign Trade," pp. 228, 291.

balance of $1,257,464,903 shown by the customs returns to be in "favor" of the United States.

American capital can place American machinery in foreign countries.

ENGINEERING EXPERTS—EDUCATIONAL METHODS.

Another way in which trade in American machinery can be promoted in Asia is through the engineering expert. When an American consulting engineer is employed in Asia he makes a great success. Being familiar with the superior methods employed here, he is not satisfied with equipment from foreign sources. It is not at all unusual for one such expert to arrange for the purchase of several hundred thousand dollars' worth of American machinery, and he wants none but the best. Similarly, when Asiatic students are trained in our universities they also learn the superiority of our machinery and our manufacturing methods. During the travels connected with the making of this investigation the writer learned of the records of many Asiatic engineers who had been trained in our schools, and although these men, as engineers, were far more expert than those trained in other countries they did not, as a rule, seem to measure up to the American standards. Realizing the influence these students can exert, the British and French are making great efforts to attract Asaitic students to their schools. American interests need have no fear of these methods, provided the students that are educated in the United States are given a good practical education, as distinguished from a theoretical, bookish training which seems to be the result of present methods. These remarks should not be taken as a reflection on these men. They are a splendid type and some of them are fine, capable engineers, but if we may deal in generalities, one gathers the impression that they have returned to Asia too soon after graduation. They need more of the "shirt-sleeves" type of training in an American environment. They need to be developed on more practical lines. Asiatic students that have been trained in America enjoy a better standing than those trained elsewhere, but it should be an easy matter to raise their standing to a much higher level. American manufacturers will find it very much to their advantage to cooperate in this matter and if they do so they have nothing to fear from Asiatic students who may be trained in Europe.

HOME ORGANIZATION.

VITAL IMPORTANCE OF SOUND METHODS AND HIGH STANDARDS.

About 1830 "Lord Macaulay said that a broken head in Coldbath Fields produced a greater sensation in London than three pitched battles in India. Lord Dalhousie, 20 years later, wrote that nothing short of a great victory or a great defeat in India was sufficient to rouse in English society even a transient interest in Indian affairs. Things indeed have advanced since then, but not to the extent that one might have anticipated. Only a few weeks ago Mr. Montagu, the Secretary of State for India, remarked that the indictment in its main essentials remains true." [6] This weakness seems inherent in all nationalities in all decades, and is observed by our colleagues

[6] From an address by G. Findlay Shirras, M. A., F. S. S., Director of Statistics, India.

in Asia at all times. One of the really important things in developing foreign business is to develop a home organization that can do its share of the work and is interested in Asia.

"America needs sane, sound business. It can have it only by study of business on scientific, clear lines. It can not have it by reliance on dumb luck and awkwardness, regardless of how great is the Nation's natural wealth or how advantageous its position by reason of the war. Europe, knowing trial and long adversity by reason of the war, will be forced to study and practice economies as never before. America can not continue its wasteful practices and hope to retain its place." [7]

In domestic business it is necessary to adopt sound business methods. In foreign trade the need is far more urgent. In domestic trade errors can be corrected. It is easy and not expensive for the branch office to write or telegraph in case of trouble. Branch managers can often step on a train in the evening and be at the plant in the morning. The business has the advantage of the verbal message and close contact between factory and user, but in business with Asia these methods are not possible. To visit the plant is impractical; the telephone does not connect; cablegrams are very costly, and letters require about a month each way. Mistakes are very expensive and must not occur. Substitutions mean trouble and dissatisfaction. No matter how perfect the organization abroad may be, it can accomplish only as much as the home organization makes possible, and for a given standard of performance the foreign department needs to be far more perfectly organized than that for domestic business. The standard established for the foreign department must be set as high as possible. Errors must not get out. Prevention is far better than cure and is also far cheaper.

SUPERVISION OF EXPORT DEPARTMENT.

In domestic business the head office must ordinarily take the initiative in matters of policy; it must supervise the whole organization, and it must cooperate with the branches. In foreign business this is all necessary to an even higher degree. "The export business requires perhaps a greater amount of executive oversight than any other portion of your business if you decide to embark in the export trade, and, if you decide to establish a department for handling the business, that department should be put in charge of no less an officer than a vice president. If the size of your establishment does not warrant the organization of a separate department for the export trade, the export business should then have the personal attention of the executive head of your business." [8] A staff should be developed that can be depended upon to handle correspondence and documents with a full realization of their meaning. The routine of shipping, insurance, and customs should be fully understood, as should also the meaning of various terms used on bills of lading, insurance policies, etc. The division of responsibility between manufacturer, carrier, export merchant, and consignee as involved in oversea trade should be fully appreciated. Weakness in these matters results in discredit abroad, while punctilious atten-

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[7] Commerce and Finance. [8] "Selling in Foreign Markets," p. 21.

tion to them goes a long way toward establishing confidence not only in the manufacturer but also in his products. The foreign customer buys service. The machine offered may be the best conceivable equipment for a given purpose, but it is useless unless it can be put into operation. There are countless difficulties that may arise before it is running in Asia. The home organization is expected to overcome these difficulties or, failing that, to be sure that all responsibility for failure lies elsewhere. Business depends upon confidence. Errors, substitutions, alterations, etc., destroy this confidence. On the other hand, if buyers abroad can be made to feel that the organization is thoroughly competent in business as well as engineering matters a good will is established that is invaluable. The writer knows of cases where business involving millions has been secured at a 25 per cent higher price because the buyer had confidence in the American firm making this quotation and did not have confidence in the German company offering the lower price.

RELATION OF EXPORT DEPARTMENT TO AGENTS.

The home office should carefully plan to furnish agents with materials needed in promoting sales. They require a liberal supply of catalogues and advertising matter if they are to do constructive work. For each salesman in each foreign office there should be a complete price list, discount sheet, and set of any confidential sales data issued. If at all practical, agents should have 60 days' notice of price changes, especially for the larger transactions. Their oriental customer does not like to meet a price advance just at the moment of closing a deal. It goes far toward disturbing his confidence. Whenever a line of machinery involves unusual technicalities a cable code should be provided that will offer facilities for communication on these subjects, having regard to emergencies and unusual transactions as well as to routine matters.

It will also probably be found necessary to consult with the agents on the subject of advertising. This subject is given separate attention elsewhere. Sometimes a manufacturer can promote his own sales by assisting an agent to secure control of a line of supplementary equipment. For example, a manufacturer of saws should encourage his agent to sell a complete line of filing-room machinery and supplies.

If a manufacturer takes interest in his agent and establishes credit relations with him, it then becomes easy to exercise supervision over these foreign sales. Obviously nothing will be gained by mere interference, but constructive efforts will be appreciated. Close contact will demonstrate the value of a given territory, the reason why orders are secured or business lost, and the needs of the sales organization. Frequently it will be discovered that the agent needs additional sales data. Ordinarily he is not an expert in every particular line and needs supervision and instruction.

This raises again the question of the sales policy. Manufacturers seem to be guilty of confused thinking on the fundamentals of an agency arrangement. Some seem anxious to receive everything and give nothing, anxious to develop a good business abroad, unable to do so for themselves, and unwilling to allow an agent such an opportunity and such protection as are necessary if constructive methods

are to be applied. Pioneering work in the building of business is hard, costly work, and a merchant is not justified in incurring the expense it involves unless he is assured that he will participate in its profits. If a manufacturer wants to develop a territory and expects an agent to do constructive work to that end he should have a clear understanding on the following points:

1. Are all inquiries from the territory to be referred to the agent without exception?
2. Is the agent to be protected, say, 10 per cent (sometimes more), on all quotations that he may ask to be made direct?
3. Is the agent to receive commission on sales made in his territory through others? Will these be paid before the agent asks them?
4. Is he to have full details regarding these sales, so as to derive advertising value from the installations when this may be possible?
5. Are prices quoted to him to equal the lowest domestic price less the cost of domestic sales? (His sales expense corresponds to that of the domestic sales force.)
6. Is a definite amount of product to be allocated to his territory even to the disadvantage of the domestic business in prosperous times?
7. Is he to be allowed an appropriation for advertising comparable to the domestic allowance?
8. How will the home organization cooperate with the agent?
9. How is the sales-promotion work to be supervised?

These questions are only suggestive and offered because experience in Asia shows the necessity of clearer thinking and sustained efforts along these lines. The energy and activity of the agent can go only as far as the cooperation of the principal allows. In America inquiries from the territory of a branch office are answered through that branch. European manufacturers make it a practice to find out the destination of the goods before quoting and do not quote direct for plant to go into an agent's territory. Loyal adherence to this policy is being adopted more and more by well-organized firms. Most of the governments of Asia have purchasing offices in New York or London. If the agent is expected to advertise among the departments of these governments in Asia and personally solicit their business, he is entitled to control prices quoted to the above-mentioned purchasing offices. A clear understanding on the above points is very necessary, and ordinarily a manufacturer will find that his interests are served best when the first seven of the questions listed above are answered positively, emphatically, and, without exception, in the affirmative. Similarly, the agent should be remembered and protected in those cases where buyers return to America to place orders, as presumably this is more or less the result of the activities of the agent.

EXPORT POLICY IN TIMES OF DEPRESSION.

There is something far more enduring about an agency agreement than is usually realized. Many of these contracts are concluded in a somewhat casual manner and treated casually thereafter—a method that is not to be recommended. These agreements, if successful, are lasting. There are many of these agreements that are more than 20 years old and, to all appearances, are going to live 20 years more. In America, for a given line of machinery, there are, say, 10 competing manufacturers; sometimes there are many more than 10. Similarly, in each of the competing European countries there are other manufacturers. But in each of the cities of Asia the number

of really good distributers is small. A manufacturer who has a satisfactory agent has an asset of value. Also, as the years pass a reputation is built. The name of the agent is associated in the minds of the purchasers with that of his principal and the product. The common good will becomes a real asset.

When conditions develop as they did in 1920–21 and manufacturers find the market gone, their stocks heavy, and "overhead" absorbing all of the profit of the business and more, there is a tendency to be strict with the agent. But it should be realized that the agent is in a worse plight than the manufacturer. His stock, though probably smaller, represents a larger proportion of his working capital. He probably has bank loans outstanding against it. The banks are demanding settlements. Interest rates are higher. Freight, duty, and other charges have been advanced. The cost per unit is very high. The market to be supplied is greatly restricted. His clients have repudiated their contracts. All foresight is wasted because of unsuspected developments. The profits of years are reabsorbed by the business in a very few months. At such times an agent deserves sympathy.

And if he asks a credit to cover at least a part of the shrinkage of his inventory, consideration should include due allowance for the good work done during a long period of years. The entire future of that market is involved in the decision. It is more than a matter of cooperation. If the agent has overstocked his market the manufacturer has similarly oversold the same market and that equipment will hang over that market until it is liquidated. There is no escape. Furthermore, no constructive development can take place through any agent until this liquidation is complete. As a market the territory is demoralized.

Unsympathetic treatment at such a time encourages disloyalty. If the dealer abandons the line for products of foreign manufacturers the work of years is destroyed; the old stock still hangs over the market and no other dealer can develop new business.

In dealing with agents the export department should realize that the businesses of manufacturer and dealer continue to be associated decade after decade, and it should develop constructive plans to correspond with that realization.

SUPERVISION OF AGENTS.

In the above it has been recommended that the manufacturer should supervise the work of his agents. This is of great consequence, for otherwise it is not possible for the manufacturer to defend his interests; but, on the other hand, this supervision must not degenerate into mere meddlesomeness. The relation between principal and agent must be thoroughly businesslike. An amusing, if not absurd, situation arises almost invariably when a manufacturer first sees a quotation as issued by his agent. The manufacturer is accustomed to sell, say, at $10,000, and here is his agent—in Japan, for example—offering the equipment for, say, 32,000 yen ($16,000). From this moment the manufacturer is unable to concentrate his mind on anything but 32,000 yen. At one moment he feels that his business is being ruined by a greedy and unfaithful agent. At the next moment he wishes to devise methods whereby he can partici-

pate in these splendid profits. Although obviously a seasoned business man, he seems in a panic; his imagination is excited. He makes a rapid mental or penciled calculation of cost, exchange, freight, duty, and is convinced that the price quoted is very high—and almost invariably he is absolutely wrong. In the first place, he will always underestimate all of the items he does include, and he will omit many that he either forgets or never heard about.

But, ordinarily, the manufacturer is wasting time if he worries about this matter. He can rely upon it that the agent knows his business and is not trifling. He is not going to kill his own business by charging inordinate profits. Competition restrains the agent as much, if not more, than it does the manufacturer. In these transactions the agent exercises certain very legitimate functions, and they should be left to him. If the manufacturer goes beyond manufacturing and attempts to act as an export merchant, he is very apt to find it expensive.

In attempting to check up on the cost of delivering a certain machine to a certain place in Asia, it should be remembered that it is very difficult to make these estimates correctly. The application of varying rates for freight, landing, and delivery, with the complication of different lift scales for each, followed by a calculation of the duty, results in an intricate calculation. "Rule of thumb" is very dangerous. But there are other items entering into the problem that even experienced men sometimes omit. Also, there are further considerations that upset the whole analysis; one of the most important of these results in including an allowance for negotiation in the quoted price. Asia does not do business on a one-price basis. Even the sale of a piece of soap is a matter for haggling and negotiation and includes a "squeeze" for somebody, and sometimes several "somebodies." Practically speaking, very few sales are made without offering a price concession upon concluding the bargain.

This also introduces the subject of secret commissions. Business in Asia pays many secret commissions, but it should be remembered that the commissions are not always illegitimate. The oriental peoples do not employ the same methods that we use. Their methods of bookkeeping are very different. Rarely do they give depreciation, obsolescence, and kindred subjects adequate consideration, and stockholders are often unwilling to make a reasonable allowance for promotion expense. Consequently, as the promoters can not reimburse themselves openly, they manage the matter by means that, to us, seem to be of a questionable nature. The following quotation from "Britons versus Germans in China," pages 49 to 51, gives an interesting British view of this subject:

> Having made several references to the fact that the Germans seemed especially to favor the method of obtaining their business by means of large secret commissions paid to Chinese officials and others, there is at least this to be said about the morality of such a proceeding. To the Chinese mind there is nothing wrong about the method. Prior to the revolution of 1911, which resulted in a republican government for China, all officials were paid such small salaries that it was quite understood they were at liberty to supplement their incomes by means of all kinds of "squeeze." From the officials down to the lowest coolie, "squeeze" is a recognized feature of Chinese life. * * * From the foregoing it must be observed that the moral principles involved by the employment of such methods constitute a nice point in China, however certain we may feel that European trade has no room for such practices.

It is only necessary to add that these remarks apply with substantially equal force to the other countries of Asia, and that the custom is older and more widespread than the influence of the Manchu régime in China. For success in foreign trade it is necessary to conform to the customs as well as the laws of the country in which one finds himself.

Without going into further details, it will be obvious that the manufacturer is scarcely in a position to carry supervision of his agents to the point of controlling their sales prices, and experience abroad shows that efforts of this kind are usually misdirected. Such "supervision" degenerates into meddlesomeness and is unwise. What is needed is intelligent, forceful salesmanship. This cooperation will bring orders to the home factory. The sales policy adopted should allow the agent ample profit. Then he will be interested. If the manufacturer gets his price, it should be satisfactory to both if the volume of sales increases.

"DIRECT TRADE."

In the Orient one hears a great deal about "direct trade." In America we hear demands for improved banking facilities and the need for more liberal terms in connection with our foreign business. Much of the comment is the result of confused thinking. It has been shown that, from the practical viewpoint, the machinery-manufacturing corporation, whether American, British, or German, is not in a position to act as a sales organization in Asia. It is interesting to analyze the matter a little further. The following table shows the different functions inherent in placing an American machine abroad, and, no matter what the nature of the organization, if the trade is handled properly, some one performs each of these functions and there is a fair cost chargeable to each one of these tasks:

1. *Manufacturer.*—Produces the goods; initiates railway shipment; issues invoices.
2. *American distributer.*—Sells products of manufacturer.
3. *Export merchant.*—Receives goods from railway; initiates ocean shipment; insures shipment; finances shipment; draws draft on importer.
4. *Import merchant.*—Meets the draft; receives the ocean shipment; delivers the goods to the user.
5. *User.*—Buys the consignment.

The manufacturer will always perform function 1 and his sales department will usually cover function 2. It is impractical for him to perform function 4. The cost of performing function 3 is, say, 2½ per cent. It should be noted that the demand for "direct trade" is a plea put forth on behalf of the small importer in Asia to escape dealing through an export merchant in America. The big houses with branches in this country prefer to do business the other way. If a merchant undertakes "direct trade," he must expand his organization to do the work that would be handled by these export offices—function 3. This work involves responsibility and expense, and if a given manufacturer quotes the same discount to a firm in Bombay that it quotes to the New York branch of a firm in Calcutta it is really allowing the Bombay house an extra 2½ per cent, provided the manufacturer's organization arranges for ocean shipment and draws the draft—all of which may be all right if it is done consciously, but is all wrong if it is done unconsciously. Cor-

respondingly, it will be noted that the question of foreign credits and sales terms does not enter the problem if a manufacturer confines his transactions to machinery dealers in Asia that maintain offices in the United States. These merchants will usually pay cash against the documents at port of export. The credit question narrows itself down to the credit of the American office during the period of manufacture, perhaps six months, as contrasted with the problem of examining the credit of an unknown foreigner, 10,000 miles away, who probably will not relieve the manufacturer of financial responsibility in less than a year. Furthermore, in case of difficulty, the problem of collecting from an American in this country is simple as compared with the task of collecting on a repudiated draft in a remote city under alien laws. This also is a situation where it is all right to arrange to deal directly with merchants in foreign cities and extend them terms of, perhaps, D. A. 120 days, provided the manufacturer does so deliberately and in so doing realizes all that is involved. If done unconsciously, it is wrong. The amount of work and financial responsibility added to the duties of the manufacturer's organization by absorbing the tasks of the exporter (function 3 above) is very considerable.

ROUTINE OF HOME ORGANIZATION.

Success in foreign business involves punctilious attention to a large volume of detail work. Every shipment requires a bill of lading, an insurance policy, an invoice, a packing list, and sometimes a certificate of origin, an agency certificate, or other forms of affidavit—all to meet the requirements of manufacturer, railway, exporter, export customs, steamship company, insurance company, bank, importer, customs officials, erecting superintendent, etc.—and a varying number of copies of each of these documents will be needed, according to the country of destination. Omissions and inaccuracies will cause trouble somewhere, usually at destination. Usually, also, they will involve expense. All should have the same mark of identification and the same description, otherwise there may be loss in an insurance or steamship adjustment or a fine in the customhouse.

The packing list should be most carefully prepared to meet the needs of many people. For staple articles like canned peaches it is very simple, indeed, but for an article like a compound Corliss engine that knocks down into 20 to 40 cases, with endless bolts, nuts, lubricators, etc. (and no two alike), the matter deserves great care. The weights and dimensions of the heavy parts should be shown and the contents of each case so detailed as to properly identify each item at the customs, for insurance purposes, in connection with pilferage claims and the like. Any one or any number of these cases may be lost through scattered shipments, fire, wreck, jettison at sea, or other cause. While these are exceptional experiences, they do occur, and it is very good policy to be ready at all times to duplicate correctly, and interchangeably, the contents of any particular case in answer to a cable request. This is not abstract theory. The writer has had experiences where it was most important.

Punctiliousness in all these details is very necessary. Very recently the writer saw a bill of lading for an oversea shipment which

called for "several packages of nails." Obviously there was no way for the consignee to protect his interests. There was no way to determine when delivery was complete and no way to be sure that all packages sent by rail actually got on board ship. Such a bill of lading is ridiculous. Similarly, others stamped with clauses relieving the carrier from responsibility for one thing or another are in themselves evidence that something was wrong with the shipment before it started. Barring those instances where it is obviously unreasonable, only clean bills of lading should be sent forward. Correspondence needs similar supervision in order that the recipient abroad may be protected from that endless variety of errors and omissions that creep into all but the most carefully prepared letters. In planning for foreign trade and laying down business policies for the guidance of the export department, manufacturers of machinery will ordinarily find it good policy to confine themselves strictly to the business of manufacturing, leaving the exporting and sales abroad to those who specialize in such work, at the same time building up a home organization that will be entirely competent to handle the manufacturer's part of the transaction.

In those cases where a manufacturer decides to absorb also the task of exporting and undertakes to deal with merchants in foreign ports, engaging in the so-called direct trade, it will also be found necessary to develop in the home organization a staff that will perform the work usually handled by the exporter. If attempted, this work should be thoroughly done, tracing the goods until they are actually on board ship and at sea. It is small satisfaction to a buyer in Asia to know that his goods have left the factory if he is not also assured that they have left the country. The writer has known of many instances in which buyers in Asia have found it necessary to take up drafts there for goods that were still on the docks in America. In some instances the goods were lost on the American railways. Their embarrassment is obvious, especially where the delay drags on for more than a year. Such a situation is hard to justify, and probably would not occur if the merchant were represented in America by a competent exporting office. The difficulty seems to arise where a manufacturer agrees to quote c. i. f. and then fails to give adequate attention to the details of exporting. It seems to show that the shippers did not have a clear conception of export proceedings and responsibility. Some of the better American firms cable a notification of the name of the ship carrying the particular goods covered by the order. Some of the less dependable firms absolve themselves from all responsibility after the goods have been delivered to the railway. As the foreign buyer can not have a traffic department in America, it is obvious that in the latter case there is a weak element in the distribution, and no manufacturer should be satisfied with such a system. The manufacturer who is building a reputation and a future can not afford to do business in that way, for it should be remembered that European countries are comparatively small, and it is the practice there to follow up the shipment until it is at sea. If quotations are made c. i. f., the maker is responsible for delivery c. i. f. During recent years competition has not been keen, but for the future Americans must expect to be held fully accountable, and in quoting c. i. f. must deliver c. i. f.

PACKING.

SUMMARY OF PRESENT SITUATION.

Packing is an old subject that has been worked over repeatedly, but like other problems it is up for consideration again because conditions have recently changed. Those American firms that have done a large export business for years find that packing that may have been perfectly satisfactory in 1913 or 1915 or 1918 is not adequate to-day. Something connected with the war has demoralized the stevedores of almost every country in the world. Cases are given much rougher handling; freight is slammed about; pilferage has increased enormously in practically every country. The home organization should give careful and sustained attention to this problem. Packing should be carefully designed and not left to the discretion of a carpenter who, though a good carpenter, has probably never seen cargo loaded on board ship. The subject is not so simple as it sometimes seems.

In the past a great deal of criticism has been directed at the way in which American goods have been packed. Some of it was justified, but those days are now largely of the past. Present-day packing of American goods compares very favorably with that from other countries. Those American manufacturers who have organized for the export trade have designed packing to protect their products, and in Asia one sees poor packing from Europe as well as from America. But as an old organization occasionally takes on a new packing-room foreman, it is well to put the principles of the problem on record.

When goods are sold, packed for shipment overseas, the manufacturer accepts responsibility for providing packing that is not only reasonably secure but will meet the requirements of carriers and insurance companies, and those restrictions have been developed through long experience.

If goods are not in cases, even if crated, the steamship will ordinarily add a clause to the bill of lading declining responsibility for damage to cargo that is "insufficiently packed." This prevents the consignee from making claim for damage, almost regardless of the way it is sustained; moreover, the provision not only applies to the one or two crates in a shipment that may have caused the amendment of the bill of lading by the above clause but will be used to escape claims on any other package that may have been damaged. Steamship companies are not altogether ethical in adjusting these items. Except in those instances where it is obviously unreasonable, goods should be so packed as to secure a clean bill of lading.

The cases must all be new cases. When goods are in second-hand cases the steamship company can not protect itself from claims for pilferage, and consequently it will not accept any responsibility for goods shipped in these old cases. The consignee has no recourse

except to the manufacturer who did the packing. This also implies that cases should be so fastened or sealed as to betray at once the fact that they have been opened. This is the consignee's protection against pilferage.

Pilferage has become a most serious problem during recent years. The trouble is found all over the world. It is made the subject of reports in London. It has attained to great proportions in Australia. In Japan conditions became very serious. Insurance underwriters have reached the point where they decline to cover more than 75 per cent of the risk. The Steamship Owners' Joint Committee at Sydney even suggested "that the practice of utilizing the cases in which goods are shipped for advertising purposes and of indicating thereon the nature of the contents be discontinued. Wharf laborers and others handling the packages, knowing thereby the exact nature of the goods they were after, could put the packages away and make their choice later at their leisure." Goods should be so packed that anyone can detect pilferage at any time.

COST OF SHIPPING LARGE PACKAGES.

For a great many reasons the size and weight of packages should be kept down to low limits. In addition to the regular freight, steamships charge a "lift scale" on heavy or bulky packages. The lift scale in force on shipments to Asia in 1920 was as follows:

Over 2 tons and up to 4 tons: Add $4 per long ton.
Over 4 tons and up to 6 tons: Add $6 per long ton.
Over 6 tons and up to 8 tons: Add $9 per long ton.
Over 8 tons and up to 10 tons: Add $13 per long ton.
Over 10 tons and up to 15 tons: Add $17 per long ton.
Over 15 tons: By special contract.

The rates named apply from and to ship's tackle and represent the increase over the basic freight rate, which varies considerably from time to time.

These charges compensate the ship for the use of special tackle and the delay involved in handling these heavy items. The writer traveled on a certain ship on which demurrage is calculated at $3,500 per day. The vessel was delayed a whole day in order to discharge six packages, each of which weighed about 10 tons.

But the above charges are only those made by the ship. A similar and greater cost is involved every time the goods are handled, as, for instance, in lighterage in New York, lighterage in Asiatic port, transshipment charges, cartage to destination, etc. The following is the lift scale for handling goods in Kobe, Japan:

By weight:
In packages up to 2 tons: 5.50 yen per ton.
In packages of 2 to 3 tons: 6.50 yen per ton.
In packages of 3 to 4 tons: 8 yen per ton.
In packages of 4 to 5 tons: 10 yen per ton.
In packages of 5 to 7 tons: 12.50 yen per ton.
In packages of 7 to 10 tons: 18 yen per ton.
In packages of 10 to 15 tons: 22 yen per ton.
In packages of 15 to 20 tons: 25 yen per ton.
In packages of 20 to 25 tons: 28 yen per ton.
In packages of 25 to 30 tons: 32 yen per ton.
In packages of 30 to 40 tons: 35 yen per ton.
In packages over 40 tons: Special.

Photograph by Philippine Bureau of Science.

FIG. 9.—BULKY PACKAGES BEING TRANSPORTED THROUGH MANILA STREETS BY BULLOCK CART.

Photograph by Philippine Bureau of Science.

FIG. 10.—COOLIES TRANSPORTING GOODS BY SHOULDER POLES.

By measurement (40 cubic feet equals 1 ton):
In packages up to 2 tons: 3 yen per ton.
In packages of 2 to 3 tons: 3.50 yen per ton.
In packages of 3 to 4 tons: 4.50 yen per ton.
In packages of 4 to 5 tons: 5.20 yen per ton.
In packages of 5 to 7 tons: 7 yen per ton.
In packages of 7 to 10 tons: 10 yen per ton.
In packages of 10 to 15 tons: 12 yen per ton.
In packages of 15 to 20 tons: 14 yen per ton.
In packages of 20 to 25 tons: 18 yen per ton.
In packages of 25 to 30 tons: 22 yen per ton.
In packages of 30 to 40 tons: 25 yen per ton.
In packages over 40 tons: Special.

In considering these figures it should be remembered that the landing facilities in Kobe are as good as those in any other port in Asia.

Similarly there is a lift scale for pieces of abnormal length. The ocean lift scale for such pieces is as follows:

For lengths 40 to 49 feet: Add $4 per long ton.
For lengths 50 to 59 feet: Add $9 per long ton.
For lengths 60 feet and upward: Special contract.

DIFFICULTY OF HANDLING LARGE PACKAGES.

From the above it is obvious that shipping large packages is expensive even under the most favorable circumstances. In addition, it involves delay and abuse. Calcutta claims to be the most important city in the British Empire except London. Bombay claims to rank third. The following is from a report prepared by an American consulting engineer, Stewart W. Marshall, who has done some very important engineering work in India and has been interested in importing there all of the equipment purchased for the Tata Iron & Steel Co. This report was prepared in 1920:

At the present time large quantities of machinery and supplies are being imported into India, and it is the experience of the Tata Iron & Steel Co. that the facilities of Calcutta are totally inadequate to handle the tonnage now passing through the port. The berths at the docks and jetties are insufficient. Handling equipment (such as cranes) is too small and the warehouse space too limited.

Unloading at the jetties is done by hydraulic cranes of about 2½ tons capacity, and, when larger pieces must be handled, this must be done either at Mullick's Ghat or at the Kidderpore Docks. At the first place the pieces must be loaded overside by the ship's tackle and a lighter and warped at Mullick's Ghat, where a single overhead gantry crane, not very modern, of 30 tons capacity, serves a storage space of approximately 10,000 square feet. This space is constantly crowded and much valuable machinery is stored in the mud outside the jetty line. The machinery in this position is partially under water at high tide. Heavier lifts can only be made at one point at the Kidderpore Docks, where there is a 100-ton tripod. As much of the machinery for the newer industries and the railways weighs more than 2½ tons, there is a great deal of unnecessary movement and rehandling required. In some cases vessels must be berthed three times before unloading completely if the loading is such that the heavy lift comes when the vessel is partially unloaded. The distance from the middle of the jetties to Mullick's Ghat is about half a mile up the river, while the heavy lift crane is nearly 3 miles downstream and inside the dock gates.

The congestion at the port is so great that at times these vessels are compelled to moor in the river for several weeks before securing a berth.

Except for Shalimar, the terminus of the Bengal-Nagpur Railway, the unloading points are all on the Calcutta side of the river. There is a 30-ton crane here, but as the river at this point is so badly silted that lighters can be placed under the crane only during a few hours at high tide, it is of little

service. In addition, it is required almost exclusively for the railroad company's service at the present time. The Bengal-Nagpur Railway has a car ferry from Garden Beach below Kidderpore to Shalimar. The car ferry can take only a limited number of the long bogie wagons, which are generally necessary for handling large or heavy pieces.

All of the docks and jetties on the Calcutta side are served by the Port Commissioners' Railway. Frequently as many as 30 or 40 of the commissioners' wagons are kept standing under load for days at a time because of the lack of wagons for dispatch or storage space on the jetties.

Little improvement has been made to the port facilities since the beginning of the war. The traffic is much greater than at any time in history and will probably continue at the present rate indefinitely. Some of the new industries are counting upon export markets, but unless the port be materially improved, the benefit which they expect to derive from improved railway facilities will be nullified by congestion in Calcutta.

These remarks are not quoted as a criticism of the Calcutta authorities. It is not at all surprising that harbor improvements were interrupted by war and, in view of conditions in the steel and money markets, have not been renewed since the armistice. But this quotation is inserted to show the difficulties encountered, under the best conditions, in the handling of large packages. The Calcutta authorities charge as follows for the use of their cranes:

For each lift not exceeding 2 tons: 1 anna per hundredweight.
For each lift exceeding 2 but not exceeding 4 tons: 1½ annas per hundredweight.
For each lift exceeding 4 but not exceeding 10 tons: 3 annas per hundredweight.
For each lift exceeding 10 but not exceeding 30 tons: 6 annas per hundredweight.
For each lift exceeding 30 but not exceeding 100 tons: 8 annas per hundredweight.

The weight of the sling is charged for separately in addition to the weight of the package. A 6-ton package, 120 hundredweight, would cost 360 annas—22 rupees 8 annas (about $9)—per lift, plus a minimum crane hire of 50 rupees and a considerable addition for coolie hire. The computations become complicated, and ordinarily the charges would accumulate to about double the values suggested by the above.

TRANSSHIPMENT OF HEAVY PACKAGES.

In the above account consideration has been given only to the problem of handling large and heavy packages on the best ocean-going vessels and in ports with the best equipment. For shipment to some of the other ports of Asia the problem becomes very much more serious. The following is the lift scale for shipments from Calcutta to Rangoon and also to ports in the Straits Settlements and the Far East, as used by the British India Steam Navigation Co. (Ltd.):

Weights.	Calcutta to Rangoon.	Calcutta to Straits and Far East.
Up to 1 ton		Ordinary rate.
Up to 1½ tons	Ordinary rate	
Between 1 and 2 tons		One and one-half times ordinary rate.
Between 1½ and 3 tons	Twice ordinary rate	
Between 2 and 3 tons		Twice ordinary rate.
Between 3 and 5 tons	Three times ordinary rate	
Between 3 and 4 tons		Two and one-half times ordinary rate.
Between 5 and 10 tons	Five times ordinary rate	
Between 4 and 5 tons		Three times ordinary rate.

Other rates are computed in like manner. All shipping and landing charges are to be defrayed by shippers and (or) consignees. Correspondingly, the following are the charges for the coastwise boats in Japan for bulky, heavy, and lengthy cargo:

Heavy cargo:
- Over 1½ tons and up to 2 tons: 50 per cent extra.
- Over 2 tons and up to 3 tons: 200 per cent extra.
- Over 2 tons and up to 4 tons: 300 per cent extra.
- Over 4 tons and up to 5 tons: 400 per cent extra.
- Over 5 tons and up to 7 tons: 500 per cent extra.
- Over 7 tons and up to 9 tons: 600 per cent extra.
- Over 9 tons and up to 11 tons: 700 per cent extra.
- For every additional 3 tons over 11 tons: 100 per cent extra.
- Over 20 tons: Special rate.

Bulky cargo:
- Over 1½ tons and up to 2 tons: Base rate.
- Over 2 tons and up to 3 tons: 20 per cent extra.
- Over 3 tons and up to 4 tons: 40 per cent extra.
- Over 4 tons and up to 5 tons: 60 per cent extra.
- Over 5 tons and up to 7 tons: 80 per cent extra.
- Over 7 tons and up to 9 tons: 100 per cent extra.
- Over 9 tons and up to 11 tons: 120 per cent extra.
- For every additional 3 tons over 11 tons: 20 per cent extra.

Lengthy cargo:
- Over 30 feet: 30 per cent extra.
- Over 35 feet: 60 per cent extra.
- Over 40 feet: Special.

Following are the formulae to be followed for calculating freight:

Heavy and bulky cargo.—For packages such as boilers, etc., on which measurement tons exceed weight tons, freight is calculated as follows: Weight tons at heavy cargo rate, plus (measurement tons less weight tons) at bulky cargo rate.

Heavy, bulky, and lengthy cargo.—On packages where weight tons exceed measurement tons, freight is calculated as follows: Weight tons at heavy cargo rate plus lengthy cargo rate.

On packages where measurement tons exceed weight tons, freight is calculated as follows: Weight tons at heavy cargo rate, plus (measurement tons less weight tons) at bulky cargo rate—plus lengthy cargo rate.

EXCESSIVE COST INVOLVED.

To illustrate the cost of handling such packages: The following is the cost for freight on a 6-ton package assumed to measure 18 tons of 40 cubic feet, from Kobe to Chemulpo:

	Yen.
Weight, 6 tons of 2,000 pounds (heavy cargo), at 8 yen (freight per ton 2,000 pounds to Chemulpo)	48.00
Plus 500 per cent of 8 yen extra for heavy cargo (as per tariff), 40 yen per ton	240.00
Plus difference of measurement tons 18, of 40 cubic feet (bulky cargo) and weight tons 6; 12 tons, at 8 yen per ton	96.00
Plus 140 per cent of 8 yen extra for bulky cargo (as per tariff), 11.20 yen per ton	134.40
	518.40

This statement omits the cost of discharging and unloading at Kobe, which would probably involve some lighter demurrage and also the cost of landing at Chemulpo. Even if we assume a freight rate of $20 per ton from American port to Japan, it is plain that the shipment of such a package from Kobe to Chemulpo would cost far more than is involved in the shipment from New York to Kobe.

These general remarks apply to all parts of Asia. Transshipment consignments that must be carried on the comparatively small and indifferently equipped vessels that engage in coastwise trade or pursue similar routes in China, the Dutch East Indies, the Philippines, etc., may involve a great deal of expense. Such vessels are often of a type that can not possibly carry a package weighing more than perhaps 7 tons, and, as the hatches are probably less than 5 feet square, it is not possible to stow bulky packages below deck, which is a serious matter in these stormy waters. It should also be remembered that excessively bulky packages, even though light, involve excessive charges for freight.

DESIRABILITY OF SHIPPING MACHINERY KNOCKED DOWN.

This illustrates the need for a competent home organization. It is all very easy to turn the packing of foreign shipments over to men who are not experienced in these matters, but the consequences are costly and react on the manufacturer just as any other unbusinesslike practice reacts. In Manila the writer saw a certain three-cylinder oil engine, which had not been knocked down at all, but went forward from the manufacturer as a single package weighing about 33,000 pounds—just under 15 long tons. This involved the importer in about $250 for excess freight, besides extra handling charges at each terminal—a sum that would have paid for a great deal of boxing. On arrival there was absolutely no way to handle it. The package was too much for either interisland boat or railway. It was not only heavy but big. Consequently it became necessary to unpack, dismantle, and repack the engine on the pier. Not only did this involve expense, but the work had to be done by men who were not trained in the handling of machinery. The risk of loss or damage to parts involved in such an experience is too great to be justified.

The above is not an isolated experience. In nine years in Asia the writer has encountered a great many cases where packers in Europe and in America have either used very bad judgment in packing equipment or else were not qualified for the work in the beginning. The packing room should be put in the hands of men experienced in boxing for export.

LIMITATIONS OF RAILWAYS IN ASIA.

The railways of Asia are not built to the standards prevailing in the United States. Frequently they are of narrow gauge, but even where the gauge is 5 feet 6 inches the loading is in many ways restricted as compared with American practice; the tunnels are small, the bridges low, the cars of small capacity, with narrow doors. Large and heavy packages involve complications out of all proportion to those experienced in America. As these standards vary greatly from railway to railway, the subject is taken up further in connection with the reports in succeeding pages covering the various countries visited.

In all of these countries the railways have followed European practice more than American practice. The carloads are small and the trainloads light, the traffic is not dense as compared with

American lines, the signaling equipment, the principles of management, the switch and siding equipment are not American, and one gains the impression that there is room for improvement.

LIMITATIONS OF OTHER METHODS OF TRANSPORT.

In Asia more cargo is handled by men than by animals and more by animals than by motor truck or railway. Probably the commonest method of removing cargo from ship side is by the shoulder of a coolie. The size of package that can be handled depends upon the men's strength, which varies greatly. The small men of Java are not nearly so strong as the powerful stevedores of northern China. When the package is a bag and comfortable to handle, a coolie can carry up to about 120 pounds, but, depending on the port and the length of "carry," it can be increased in some cases, even exceeding 200 pounds. If the package is a box and two can be carried on a pole over the shoulders, this weight should be divided, so it is convenient to pack in cases of possibly 60 to 100 pounds each. But this is not really important, as two men can easily work one pole, thereby caring for loads up to 200 (sometimes 300) pounds. Beyond this point the package becomes a more difficult problem, and yet it is astounding what these men can do. They are very clever in distributing shoulder poles around a load. In Shanghai the writer saw (and heard) 42 coolies carry a case weighing 1,800 pounds. In Java 15 coolies were seen carrying an ordinary piano, while a similar piano was carried by eight men in Calcutta, where it was reported that such instruments are sometimes sent 300 miles and to 5,000 feet elevation entirely by this method. The subject becomes entertaining, but obviously it is well to keep weights and dimensions down as much as is at all reasonable.

One seldom sees mules used in Asia, though it is done. Packages for these little burros should be kept down to about 80 pounds on each side. Camels are used in some districts but not very commonly, and for camel back the load should not exceed 170 pounds on each side unless the distance to be covered is short.

Bullock carts (or their equivalent, camel carts in Karachi, horses in Japan) are of a great variety of type and are common almost everywhere in Asia, except China, where there are few roads. The Philippine type has a capacity up to about 1,600 pounds and, on good roads, can make a speed of about 3 miles per hour. For a load as illustrated opposite page 48, the weight of each package should be less than 500 pounds and every dimension less than 5 feet.

POSSIBILITY OF DELIVERING HEAVY PACKAGES.

Without going into greater detail, it is apparent that, within reason, machinery shipped to Asia should be sent forward in small packages, but, except for the most unusual installations, it is not necessary to go to extremes in this matter. It is a case of increased convenience and reduced costs rather than a matter of dealing with the impossible. On the other hand, the problem of delivering a 10,000-kilowatt steam turbine from ship to power plant in any of these eastern cities is really very difficult because they are parts that can not be knocked down. An instance was reported of a dredge

that was purchased for £80,000 and cost £100,000 to deliver. This dredge was used on placer tin in Malaysia and was carried through the jungle over a mountain 5,000 feet high.

Very often delivery is very expensive, and it is good business for the manufacturer to consider not the cost of his product f. o. b. factory but delivered to the ultimate user in Asia, for that is the cost that is really important.

STRENGTH OF PACKING.

Domestic packing will not suffice for export shipments, since these are subjected to more handling and much rougher handling than a domestic shipment. Each case is not only shifted and thrown about at least a dozen times but, when it is in a car of package freight, the rough switching and braking, the sudden stops and starts, rack every joint, loosening nails and splitting boards. When rolled onto the floor or from car to pier or lighter it may land on a corner and strain again. In loading and discharging ships, a whole series of new strains are applied. Opposite page 55 are illustrations of cargo being discharged at Manila. These cases are slung together in a net of wire rope and each slingful weighs up to 5 tons. As it lifts, the sides draw together, not gently but with an action not unlike that of the jaws of a stone crusher. Obviously a box made of thin lumber will fail. As the load swings in lifting, it quite commonly strikes a bulkhead or the side of the hatchway. As it is swung outboard it may crash against the rail or warehouse. As it is lowered it is very apt to batter against the ship's side, and the landing on the pier or in the lighter is never gentle. The pile is then toppled over and each case carried away. In the upper illustration a small box will be noted at the bottom of the load. It is doomed to have a nasty landing. In the lower illustration an effort is being made to lower a slingful of boxes, certainly over 10 feet in diameter, between the ship's side and the warehouse, which are about 8 feet apart. These photographs were taken in the course of the ordinary discharge of a steamer. No posing was done. They represent discharge under favorable conditions with practically every modern convenience at hand. When it is necessary to anchor outside and discharge into a lighter on a rainy night with a sea running, with all hands hurrying to clear the ship so that it can get away before the turn of the tide, as must be done in some instances, then the treatment is very rough, indeed. Stevedores are a rough class of men at best. When ship demurrage runs into several thousand dollars a day and a turn of the tide will delay a vessel possibly as much as a day, these men have no time to spend in devoting tender care to a weak package.

This matter of the treatment of freight can be clearly understood, at least as it developed in one instance, from the photographs on the opposite page. While the writer was on the docks in Tandjong Priok (the port of Batavia, Java) cargo was being discharged as shown. In every instance the method adopted destroyed the packing as illustrated. The intelligence of the freight handlers can be estimated from the pictures, and also their concern as to the condition of the commodities involved. What good would it do to mark these cases, "This side up with care" or "Fragile"? And in these matters Java resembles China or India or Japan.

FIG. 11.—DISCHARGING CARGO AT BATAVIA: ONE WAY IN WHICH CASES ARE STRAINED.

FIG. 12.—THE EFFECTS OF THE STRAIN.

FIGS. 13 AND 14.—DISCHARGING CARGO AT MANILA.

PACKING SPECIFICATIONS.

The following cases have been found satisfactory in practice and may serve as a basis for comparison in connection with other problems:

The Singer Sewing Machine Co. has its own branches in Asia and ships thousands of its machines there. As its packing represents a situation where the interests of all parties (manufacturer, exporter, importer, and consumer) have been carefully considered, including the costs, the specification is believed to represent the best that can be done as regards both size and strength of package: Case for a single hand-driven machine—Weight, 88 pounds net and 132 pounds gross; size, 16 by $18\frac{1}{2}$ by $22\frac{1}{4}$ inches; ends, pine, $\frac{3}{4}$ inch thick; sides, pine, $\frac{5}{8}$ inch thick; all bound with 1-inch strap iron. Inside the case is straw packing wrapped in brown paper, making cushions about 3 inches thick. A strong wooden partition separates the machine from the cover, and the attachments are packed inside the cover.

When larger shipments are made, especially of treadle-type machines, the shipment of four heads in a single case does not work out well. The weight seems to be too much for the coolies, and rough treatment follows. With two such heads in a case the following specification applies: Weight, 64 pounds net, 75 pounds gross; size, 19 by 14 by 17 inches; all made of $\frac{7}{8}$-inch pine and $\frac{5}{8}$-inch strap iron; padding, etc., inside is needed.

To accompany such a shipment the legs and treadles for four machines would be shipped together in the following box: Weight, 102 pounds net, 130 pounds gross; size, 33 by 21 by 14 inches; all made of $\frac{7}{8}$-inch pine and $\frac{5}{8}$-inch strap iron. Correspondingly, the cross braces and band wheels for four machines are sent together, crated as follows: Weight, 52 pounds net, 67 pounds gross; size, 24 by 23 by 7 inches; all made of $\frac{7}{8}$-inch pine.

For the shipment of small machines the above type of packing can be strongly recommended as representing extensive experience, and, as costs are watched very closely, it is no better than is necessary. In fact, in recent years freight handlers everywhere seem to have grown more careless and, owing to the increased amount of damage, it may become necessary to strengthen the above cases. For heavier machinery heavier packing is needed. The following case has been found satisfactory for the bed of a lathe 18 inches by 8 feet, weighing 3,620 pounds net, 4,255 pounds gross, requiring a case 10 feet 10 inches long, 3 feet 4 inches wide, and 3 feet high inside. The case is worked up from two $3\frac{1}{2}$ by 5 inch skids on the bottom, to which the lathe is bolted. Above these skids the frame of the case is made of 2 by 4's and the whole covered with $\frac{7}{8}$-inch boards about 9 inches wide. The case is strengthened at all corners with strap iron and should be lined with waterproof paper for rain protection.

PACKING INSIDE OF THE CASE.

If a package is found damaged at destination, having come forward on a clean bill of lading, the carrier is responsible, but he can not be held for breakage inside of an undamaged case (except in unusual circumstances). Loss on this account is legitimately chargeable to the party responsible for packing the shipment, and usually

this is the manufacturer. The writer once saw a shipment where the flywheels for 24 oil engines had been shipped with the parts for the flywheel governors in place. On arrival at port in Asia, every governor was found broken, usually the weights having broken off. How could the agent properly represent the manufacturer in such a case? The facilities for welding were not good. There was no certainty that many of the parts had not been lost. Anyway, who wants welded castings for such service? Is the manufacturer willing to pay for making and machining new castings?

A certain electric lighting set, of the type now common for farm lighting, involves the use of a storage battery of, say, 50 cells. These were shipped to Asia with the grids inside of the glass jars. At destination only two of these jars were not broken. It required months to get new jars, and the set was out of service during that period, involving an interest loss of consequence.

An engine was fitted with a forced feed lubricator which was shipped in place, being mounted on a cast-iron bracket. Somewhere in transit the bracket broke, allowing the lubricator to rattle around inside the case for the rest of the journey, and obviously it did a good deal of damage. A similar but worse case was where an electric rheostat got away from its fastenings. Since this was heavier, more damage was done.

In all of these cases the packers blundered, presumably from lack of supervision. The manufacturer is responsible and should pay the costs involved, consequential as well as direct. But even by so doing he can not correct his error, and his customer has battered equipment. Extreme dissatisfaction arises from these examples of carelessness. They may involve a delay of months, with interest charges accumulating. Sometimes repairs are necessary, but these are never as good as the original piece ought to have been and, moreover, are expensive. If it is a welding job, it is sometimes impossible to get the welding done and at best a welded part is not up to standard. These are all makeshifts, and makeshifts are bad business. Such incidents destroy confidence, which is the real basis of trade.

EFFECT OF CLIMATE ON PACKING.

On shipment to Asia machinery is exposed to extreme variations of climate and must be protected from it. Suez shipments involve passage through the Red Sea, which is always hot. For the whole voyage the humidity is high. Very probably the ship will make some port during the rainy season. Leather is almost sure to mold, cloth to mildew, insulation to absorb moisture, and bright surfaces to rust unless carefully protected. Some products require tin-lined cases, but for electrical machinery and parts that can rust it is usually sufficient to use waterproof paper. If finished, surfaces are covered with a rust-proof coating. For rougher classes of equipment no special protection is provided.

MARKING.

The order from abroad usually indicates how the packages are to be marked for identification, and these instructions should be followed most carefully. Furthermore, this marking should be of a size and color and with a material that will be durable and con-

FIG. 15.—UNLOADING CABLE IN INDIA.

FIG. 16.—DISCHARGING MACHINERY AT MADRAS, INDIA.

FIGS. 17 AND 18.—METHODS OF TRANSPORTING MACHINERY IN INDIA.

spicuous, and should appear on two different sides of each case. Also steamship rules, customs rules, and the like usually require that each case be marked with gross weight, net weight, and dimensions. When there are a number of cases in a consignment of varying contents, each should have an identifying number so that the foundation bolts may be found by reference to the packing list without opening every case for this purpose. At every port in Asia there are quantities of cargo that can not be delivered because the marks are gone. This represents trouble, worry, and loss for some one. The marks on packages and documents must agree. Clerical errors in these matters are most annoying and expensive. But when cases are marked "This side up with care," or a bale "Use no hooks," etc., it becomes amusing, because probably there is not a coolie engaged in this work in all Asia who can read such a notice. If a case is not to be turned upside down, it should be made with a top that prevents this, as is commonly done with carboys of acid. In shipping airplanes to France during the war the cases were provided with slings of wire rope, which were so fastened as to keep the cases right side up, and, when slung, they were always under the strains anticipated.

There is further information on this subject in "Selling in Foreign Markets" that deserves study. But it all comes down to the point that packing should be designed, not thrown together haphazard. The lumber should be strong and free from knots, the nails of ample size and quantity, and the whole put together with plenty of hoop iron and so assembled as to give protection against weather, rough handling, and pilferage.

On the other hand, it often happens that buyers in Asia become a little unreasonable on this matter. If any little difficulty that appears at destination can be attributed to packing, the consignee may feel that the shipper is negligent, forgetting for the moment that it would be prohibitively expensive to pack so as to eliminate all possibility of damage. Our most experienced exporters now have a standard package, and quotations cover this form of packing, it being further understood that the goods will be shipped in any other type of container for appropriate change in price. It is remarkable how quickly the mention of a higher cost eliminates unjustifiable criticism of this kind.

ADVERTISING.

CONDITIONS JUSTIFYING EXPENDITURE.

A good deal of advertising might be employed advantageously in promoting American machinery sales in Asia. As has been pointed out, American machinery is a product of especially high quality that can be sold only at a comparatively high price, and such merchandising requires salesmanship and advertising. In using the word advertising in this way it is meant to include not only publicity in newspapers, technical papers, and the like, but also the use of mailing lists, personal letters, and a great variety of other methods.

The advertising problem should have the careful thought of the home organization. It involves the building up of the good will of the manufacturer, and yet the conditions are such that the problem must to a large degree be handled by the men who are abroad, as they have the most intimate contact with the sentiment and prejudices in each particular market. Also, the advertising campaign in each country should be modified to suit local conditions.

On page 3 it has been shown that although Asia absorbed only about 7 per cent of the American machinery exports in the years 1910 to 1915, the participation is rising rapidly, and for 1921 it was about 25 per cent. In the table on page 6 it has been shown that there is plenty of opportunity to increase our machinery sales, especially in China, the Dutch East Indies, British India, and other markets. Also, in addition to increasing our share in the existing trade, there is plenty of opportunity to increase the amount of the total trade, even in the markets of the Philippines, Japan, etc.

Present conditions in all of the Asiatic countries justify judicious advertising on behalf of certain classes of industrial machinery. Everywhere there is eagerness for industrial development. In addition to such sentiment as existed before the war, the feeling has been greatly intensified since 1914. Various perils demonstrated not only the needs of the several countries but also their resources and, to many, the profits that will reward successful promotion. People of means are keenly interested; people in general are in sympathy; and for political and general reasons, governments are prepared to lend their support as never before. It is also gratifying to note that this has been manifested in a solid sort of way. Where in earlier instances enthusiasm carried people into boom-time recklessness, there now seems also to be a solid conservatism that looks into the limitations of a district or project as well as into its possibilities. Meanwhile governments are attempting constructive work through geological and water-power surveys, scientific agriculture, and expanded educational activities. Men want to know where to get machinery, but more than that it interests them to know what it can do and how to go about establishing certain kinds of industries, what proc-

esses are involved, and how to promote enterprises. Asia needs legitimate promoters and competent, honest consulting engineers.

Advertising is a success in Asia, as elsewhere, when done properly. Cigarettes, patent medicines, tooth powder, and the like appeal for one's patronage from Siberia to Java. Sewing machines, automobiles, and electric fans are called to one's attention in every port in Asia. These and a thousand other appeals are made scientifically and effectively. Asia has absorbed and uses the idea of advertising.

NEWSPAPER AND PERIODICAL ADVERTISING.

Newspapers in European and Asiatic languages are published in every port in Asia and are useful in advertising legal notices, powers of attorney, changes of address, new organizations, and the like; they are also useful in those instances where one wants to keep a name before the public, but they are probably of negligible value in the technical advertising of machinery proper. Their appeal is not directed to the engineering community, and returns that might accrue from the publication in them of descriptions of band saws and machine tools are purely incidental and would probably be prohibitively expensive. Their message can scarcely go beyond the most superficial generalities.

In Japan, China, and India there are a number of magazines, a few of which appeal more especially to the engineering and industrial communities. When these are published in English they are frequently used to appeal to the European and English-reading Asiatic merchants, promoters, and experts in the territory. Depending upon the circumstances of the case, these magazines can be useful for certain appeals. When these magazines are in the vernacular they can be used to appeal to that larger class of students, engineers, superintendents, and managers who are ambitious to learn as much as possible on technical subjects. Here again certain appeals can be made effectively, although this involves the dangers encountered in advertising in a foreign tongue to minds that do not regularly follow American processes of reasoning. It should be remembered that these journals are not up to the standard of American trade and technical papers, but are of a more popular character; their circulations are modest and the limitations of such advertising are obvious. Also, certain American technical journals go regularly to each of these countries, and undoubtedly have a strong influence on those whom they reach. But one could scarcely develop a well-rounded advertising campaign in any Asiatic country in this way, and it is felt that Asia deserves some really scientific advertising of American machinery.

ADVERTISING BY MAIL.

The most promising method is advertising by mail. As this implies a very personal appeal it can usually be conducted to the best advantage by the agents in the field, who should have well-handled mailing lists. These men have an intimate knowledge of local conditions and will instinctively avoid that which displeases and also will catch the idea, the idiom, or localism that clinches the appeal. They will avoid the impractical and expend their energies and

appropriations in the direction that will be truly effective. They will avoid the ridiculous mistakes that the alien sometimes makes. Advertising and salesmanship supplement each other. The man on the ground is able to coordinate the two. The best results will ordinarily be secured by arranging to have the agent manage the advertising, but the manufacturer should exercise enough supervision to know what is being done, and, more important still, he should assure himself that something worth while is being attempted.

Usually it will be found that the great need is for educational advertising. The manufacturer must not assume that the people of Asia are familiar with his own or similar products. It is necessary to start from the point of view of the prospective buyer. It is necessary to show him what machinery can do and how to do it. For example, one successful merchant issued booklets pointing out the convenience of electric lighting and showed how to form a corporation and how to secure a franchise. It is this sort of thing that is practical and meets the needs of Asia, where there are plenty of people with money (surrounded by desperate poverty), who do not understand how to employ it. It has taken a great deal of time, money, and work to educate the American people up to their present position. The men of Asia need the same training. The Japanese, the Chinese, the Filipinos, and other peoples of Asia are quick to see the advantages of modern machinery, but they need, in addition, organizing ability, capacity for management, and a certain amount of technical education. The machinery dealer in Asia knows what is needed and is more than ready to do his part, but he needs also the cooperation of the manufacturer, who, after all, should take the initiative. Also it should be remembered that the machinery dealer in the Far East finds it necessary to be a good deal of an engineer, a merchant, a banker, a shipper, and a great deal besides, and can scarcely be expected to be expert in advertising. The plan should be to lead these dealers to understand and use modern methods in their work. American sales methods and American advertising have never been surpassed. If the American manufacturer can arrange to have these applied in behalf of his business in Asia, he does not need to worry about foreign competition.

All the above emphasizes the close nature of the cooperation that should exist between manufacturer and agent, and has reference especially to the needs of the manufacturer, but there is also the other side. Attention should be given to the needs of the agent. If an agency has been properly established it should be practically permanent. There are plenty of these agreements in force that have continued for more than 20 years. In such cases the manufacturer should have confidence in his agent and should wish to have the agent known, in addition to advertising the goods. The good will of the agent supports the good will of the manufacturer. The organizations together form a team. Frequently it is good policy for the manufacturer to arrange his plans so as to advertise the agent.

Some British manufacturers advertise by utilizing the cases. For machinery this may sometimes be useful, but it should also be remembered that it encourages pilfering if the contents are attractive to wharf laborers.

CATALOGUES FOR USE IN ASIA.

In connection with mailing-list advertising as mentioned above, and also to illustrate or supplement proposals, the agent will require catalogues, specification forms, bulletins, and folders of various kinds. Very commonly those used in the American markets will be found to meet all requirements, as English is the language of trade or may be used in trade practically everywhere in Asia, and those who are seriously interested in factory machinery usually have a good working knowledge of English. There are times when a catalogue in Japanese or Chinese would be useful. In the Philippines about one Spanish catalogue would be used for every four in English. In Indo-China French catalogues would be useful, and in the Dutch East Indies catalogues in Dutch could be used, but in all of these countries a good English catalogue is very serviceable.

So far as marketing industrial machinery is concerned, there are very few cases where the demand is large enough to justify the publication of a special catalogue in any of these languages. In those cases where manufacturers have attempted to do this they have frequently wasted their time and money, as the appeal is often destroyed if not couched in good, forceful idiom of the language involved, and incorrect use of language invites ridicule.

When catalogues are issued in a foreign language—for example, Spanish—care should be exercised to have the catalogue Spanish in spirit and not a literal translation of some English publication. This is usually difficult, but necessary. The work should be placed in the hands of a capable man who should edit rather than translate the catalogue into Spanish. Failing this, the message will not have the influence anticipated. This subject is treated more fully in "Selling in Foreign Markets." It may be illustrated by one or two instances where Japanese have used English incorrectly. In Kobe there is a sign reading: "Dr. Med. S. Fujii—Innerist." Evidently this physician does not specialize on skin diseases. This reminds one of the sign once exposed at a garden party: "Visitors are not allowed to accompany dog into garden." Reports received indicate that Americans are not altogether free from errors corresponding to the above when they attempt to publish catalogues in alien tongues. As has been stated, such catalogues are seldom needed in connection with the sale of factory machinery in Asia; but, if attempted, these publications should be most carefully checked by the agent before distribution.

In publishing a catalogue for use in foreign trade one should exercise especial care to furnish all of the data required. Regardless of the nature of his representation the manufacturer should remember that, at the moment his catalogue is being consulted, it is his only representative before a potential customer, say, 10,000 miles from his office. In all probability this customer has never used such machinery before and is confronted with all of the multitude of difficulties involved in getting the unit out and starting it to work. A well-prepared, complete catalogue will inspire confidence. Insufficient data tend to destroy it.

Such a catalogue should be liberally illustrated. A good photograph often tells more than pages of descriptive matter and can be

read in any language. In recent years the specifications issued by makers of air compressors in America have been especially clear in their descriptions, and it is suggested that this type of trade literature is particularly suitable for use in Asia. Good paper, good clear type, good illustrations, and good workmanship are probably more effective in Asia than in America. The buyer in the East very commonly has much more time and inclination to read these publications closely than the man at home.

Sometimes American catalogues give the impression that they were prepared for the American market. Very often European catalogues are prepared to appeal to the world market. In composing a catalogue for use abroad the writer should include all of the data needed for foreign shipments and should have in mind European and other competition as well as that to be expected from the usual American firms.

INADVISABILITY OF GIVING PRICES IN CATALOGUES.

Prices should not appear in the catalogue. There are many reasons for this. It is not possible to print a price that will be correct for any considerable period of time. Costs fluctuate, and a price that gives a wrong impression is worse than no price at all. It is not possible to print a price c. i. f. all the ports of Asia, and a price f. o. b. factory is sure to confuse persons who are not familiar with the details of estimating the remaining items. The uninitiated will always omit items, and this has the effect of making things awkward for the agent. A very inexperienced buyer sometimes expects the printed price to indicate the cost in his native village or, even worse, knowing a little of discounts he will expect the delivered cost to be less than the one indicated.

The writer has before him a discount sheet issued by an American manufacturer of machinery but printed in Spanish. Plainly it was designed solely for the export business, as was also the priced catalogue, also in Spanish, to which it refers, and yet it calls for increases over the printed prices of from 35 to 60 per cent for delivery f. a. s. New York. This sort of situation introduces a great deal of unnecessary confusion into the negotiations and serves no useful purpose. A separate price list is far more satisfactory and serves all the purposes of a priced catalogue with separate discount sheet.

If the idea of publishing the prices is to restrict the agent's profits it defeats itself. In the first place, it betrays a lack of confidence in the agent which should never exist. As explained more fully elsewhere, the agent will not kill his own business with inordinate profits; business in Asia is not on the one-price basis; sometimes the price for machinery covers the cost of promoting the enterprise, etc. The agent should be supplied liberally with price data and all other forms of confidential sales data, but these should not be released to the public in Asia.

The catalogue should be numbered and dated. The number will indicate whether two editions that may be at hand in the carefully preserved files of an office in Asia are consecutive. The date will indicate, in some degree, whether it is obsolete.

CODE WORDS AND IDENTIFICATION NUMBERS.

The best method of identifying a machine for all purposes is by means of a code word. Such words should be used liberally but with great care, and each should have exactly five letters. When possible these should be taken from the appropriate section of some first-class code book and selected by a competent cable man, as he can often select combinations of letters that will enable him to correct messages that may be somewhat mutilated when received.

Each time a design is changed the code word should be changed. If care is exercised in these matters the code word can be made most useful for identifying the machine in correspondence as well as cables, and prices can be named or repairs ordered on this basis.

A few cable clauses covering the expressions or requirements peculiar to the machinery are frequently useful and probably should be included. These should be carefully thought out to supplement the usual codes as may be necessary to meet the ordinary business needs.

It is surprising how often the maker's name and address are left off catalogues and circulars. The writer has seen prospective buyers in Asia hunt unsuccessfully for hours for the name of the maker of an American article for which they had a catalogue. Catalogues and leaflets often get separated from the accompanying correspondence. Filing all of this disconnected information is very difficult. Manufacturers will serve their own interests by making these matters as easy as possible.

For ordering repairs, illustrations accompanied by identification numbers are very useful. The methods followed by some makers of agricultural implements are recommended in this connection. Very explicit erecting instructions and operating instructions are especially needed in Asia, where the equipment often is placed in the hands of a man who is entirely unfamiliar with it and sometimes is a very indifferent sort of mechanic. Also he often has very little time in which to get the plant in operation. These emergencies occur everywhere.

LEAFLETS.

When the commodity is to be sold from the agent's stock as bicycles are retailed in America, it is frequently found wise to send a number of leaflets describing the materials at the time of forwarding the shipment. In this way the agent is sure to have literature accurately describing the exact article at the time advertising matter is needed. These leaflets are not very expensive but are exceedingly useful and greatly appreciated. Usually the agent's name and address are printed on the leaflet. This increases their value, but in some countries outside of Asia duty is charged on such printed matter.

PRICE LISTS AND DISCOUNT SHEETS.

Price lists and discount sheets should also be prepared with great care. Each issue should be complete in itself and should be numbered and dated. A good merchant firm abroad may represent from 20 to 100 manufacturers, and it is most difficult and time-consuming to keep all of this data correctly and completely filed.

Such work can only be done by competent men, usually the sales engineers themselves. Asiatic clerks can not be trusted to do it. As the engineer's time is usually very valuable, his task should be simplified as much as possible for the good of all concerned. With the price list or discount sheet should be a table giving full shipping data for each machine, so as to enable the salesman to estimate the freight accurately. As was more fully explained in the discussion of packing in this report, it is necessary to know the weight and cubic contents or measurements of each package in a shipment if one is to estimate freight and handling charges at all closely, because of the operation of the freight tariffs and "lift scales," and it is obviously to the advantage of the manufacturer to have these estimates as accurate as possible.

CALENDARS AND NOVELTIES.

The Chinese have not yet adopted the Gregorian calendar and, in addition to an arrangement all their own, have holidays and lucky days and days of bad omen. The Japanese have adopted the western calendar, but have not altogether abandoned the older form. In India and in the Philippines there are a great many holidays not celebrated in America. In all these countries a calendar that is well prepared and designed to include this local information is highly esteemed. The success of this sort of advertising depends a great deal upon meeting the conditions of the particular territory and should be prepared from a thorough knowledge of these requirements.

Playing cards, knives, rules, matches, match boxes, and a great variety of other novelties are sometimes employed for advertising purposes. In some cases they are very effective, while in others they have failed miserably. Success in this direction requires a good deal of skill and local knowledge.

FREE ADVERTISING.

Unfortunately very few of the newspapers and magazines of Asia are American, and it is only natural that our ways, our letters, and our goods are not appreciated because they are not understood. News from America that is published in Asia is often of the type that one might wish suppressed. Our real achievements often pass unnoticed. Sometimes an eastern editor will receive from America a little "copy" which in reality advertises some American commodity. He takes advantage of this to attack the sender for trying to get something for nothing. Sometimes in the same paper one will find what at least appears to be free advertising of European goods. At other times there will be articles lauding the superior achievements of European engineers or European machines. Frequently these articles are obviously from the pen of one who has no knowledge of engineering matters and whose work is ludicrous in the eyes of technical men if not of the world at large. However, the fact remains that Americans are at a disadvantage in matters of this kind, and it is not wise to solicit "free advertising." The effect of hostile propaganda of this and other types can be overcome most effectively by judicious mail advertising. These methods are dis-

tinctly American and probably will not be well employed by others. Presumably they would be employed more often by our manufacturers if the existing situation were more fully appreciated.

The frame of mind of some of these eastern editors may be gauged by the following quotation from one of the best-known British newspapers published east of Suez. In reading the following it will be well to bear in mind the figures for the Japan machinery trade as given on page 288:

A COMMERCIAL EFFLORESCENCE.

During the three years before the war the imports into Japan from Great Britain and from the United States were approximately equal, the following being the figures:

Years.	From United States.	From Great Britain.
	Yen.	*Yen.*
1912	127,015,757	116,146,973
1913	122,408,361	122,736,970
1914	96,771,077	92,302,307

How greatly this has become changed may be seen in the following figures for the past three years:

Years.	From United States.	From Great Britain.
	Yen.	*Yen.*
1917	359,707,835	63,304,384
1918	626,025,530	66,067,257
1919 (11 months)	689,155,348	107,076,696

The United States is now Japan's biggest customer both for imports and exports, and the trade between Japan and the United States is approaching within measurable distance of that between Japan and all Asia. There is also this great difference between the American and the Asiatic trade, that whereas the great bulk of Asiatic imports into Japan consists of raw materials, those from America are mainly manufactured goods, and according to the canons of modern commerce there is more advantage in supplying manufactures than in supplying raw products. Notwithstanding this great increase, and notwithstanding the restoration of peace, greater things are looked forward to in the American-Japanese trade. Both countries are full of war profits that need spending, and Japan in particular is hungering for the machinery for building up a manufacturing trade which she has been unable to get owing to war conditions, while she has plenty of money to pay for it. Though we hear of competition in Pacific freights, it is certain that there will be plenty of cargo to carry for a long time yet.

It is not, however, with trade itself, but with one of its efflorescences that we would deal on this occasion. Everybody must have noticed the rank crop that has sprung up of trade magazines. Formerly American advertising was hardly seen in the Orient, at least in Japan. While in their own country, Americans were the greatest and most systematic advertisers in the world, in the Orient they were decidedly conservative and gave little sign of the recognition of the value of publicity so marked in their domestic commerce. American advertising was something like American banking—very active at home and not at all enterprising abroad.

All that has been completely changed, and the main features of the changes are very interesting. It was first manifest in South America. In the southern continent there had for years been American commercial journals of a somewhat formal type in which those who did South American trade ran advertise-

ments. Generally the advertisements were as modest as the trade they subserved, and it was only because they were so modest that the firms concerned kept them on. They did not, at enormous expense, shout at the South American public as the makers of motor cars shout at the 2,000,000 readers of the Saturday Evening Post from glaring double-page pictorial displays, and naturally the results were not so carefully watched and calculated as are such extravagant plunges into publicity. However, when war broke out in Europe and business, especially British business, was far from being "as usual," the proprietors of these modest and conservative South American advertisements began to be snowed under with orders and inquiries. It was a sudden revelation in the value of foreign advertising, and there was a rush to take greater advantage of it. In the chaotic state of affairs which has resulted from the war, this rush for publicity has as much of gambling in it as business itself. The excesses of the motor-car people, already referred to, were not madness but method. In much of what is now being done abroad there is more madness than method.

The commercial journals which now exist in such abundance are an evidence * * * of superfluity and insecurity rather than orderly evolution and development. Manufacturers who have reaped good harvests sow broadcast with a careless hand, easily persuaded that a little "hot air" will make even the wayside and the thorns productive places. When they have time to check results there will be a great change. Most of the commercial magazines which have sprung up so abundantly are pure fakes. They are very largely given away because they have to advertise themselves and nobody wants to read them. In some cases they have even ceased to supply reading matter and consist wholly of advertisements. In a time when people are gambling in the wildest fashion and trying new ventures without calculations, even this gratuitous distribution of pretended reading matter or frankly empty masses of advertisements finds people to turn its pages and to place speculative orders in spite of the sound journalistic maxim that what is not bought will not be read, and in days when profits are so fanciful these carry the thing through. The most unblushing fakes are perpetrated. Speeches on commercial subjects by Government officials are clipped from the newspapers and inserted as special articles, and valueless commercial information gains acknowledgment from the supposition of everybody who looks at it that it is probably useful to somebody else.

Among these many bows drawn at a venture, however, not a sufficient number, even in these chaotic days, can reach enough marks to enable the present efflorescence of commercial magazines to continue. So far as those are concerned which cater for the oriental trade, advertisers will discover that, except in the case of certain very restricted lines, no business can be done without a good agent or, better still, a man of their own on the spot. Advertising, essential as a reminder, will not do business by itself. Publications whose reading matter is a mere perfunctory camouflage to their advertisements will not be able to persuade the advertisers, in more cautious times than these, that they are earning their right to exist, and when the world settles down there will be an extensive weeding out. Even now there are plenty of barren fig trees which wither after a brief and brave show of leaves. Trade across the Pacific may be confidently expected to flourish and increase for years to come, but many of what now appear to be its evidences of health are really only the hectic flushes of the speculative fever to which it is subject before its acclimatization. Such symptoms form an interesting subject of study, but are in themselves rather morbid than otherwise. It is only the fact that there is a great and increasing trade of a solid and enduring quality that makes it possible that the reaction from the present orgy of commercial journalism will be comparatively gentle.

TYPES OF MACHINERY SUITABLE FOR ASIA.

As a general rule it may be stated that a given line of machinery will be suitable for Asia if it gives full satisfaction in America. It is true that some European engineers in Asia criticize American machinery rather freely, but very often such criticism will not bear analysis. As has been stated previously, most American machinery is of superior quality and enjoys an excellent reputation in the markets of the world. The writer has been privileged to see one or two confidential reports made by European engineers, representing the result of thorough investigations into the merits of certain classes of American machinery, and they were all that any American could wish. A great deal of comment has sometimes been made alleging that American machinery is of light weight and designed for short life, but most of these remarks are not justified. Machine for machine and detail for detail, plant for plant and design for design, American engineering is well in advance of that known in other lands. It is interesting to note in this connection that certain European manufacturers are beginning to adopt American types of construction, to follow American methods in manufacture, and to employ American engineers to manage production in their factories.

INFLUENCE OF LABOR CONDITIONS.

On the other hand, oriental labor is different from our labor, and machinery for use in Asia should be as simple, rugged, and "fool proof" as possible. In the eye of a coolie a lathe bed is the same as an anvil, and his appreciation of good workmanship has not been educated to the point where he is at all disturbed if scraped or ground surfaces are battered up. He is just as willing to use a Stilson wrench or a chisel on a nickel-plated nut or coupling as the stage type of American plumber. If a machine can injure itself by overtravel or the like, he can be relied upon to be guilty of the neglect that may be needed to cause this to happen. But we should not criticize him. He is a man who has had no opportunities. Living conditions leave him not only uneducated but unclothed, unfed, and exposed to disease. The epidemic of influenza that spread all over the world in 1918-19 is said to have caused 6,000,000 deaths in British India. In certain large sections of India it is said that 90 per cent of the population is infected with hookworm. Hundreds of thousands have a wardrobe certainly representing less than 25 cents each. It has been said that in India alone 100,000,000 people are on the verge of starvation at all times, and a shortage of crops involves untold suffering. In case of crop failure there is famine and many die.

There are sections where it is reported that the workman pawns his bed in the morning to get his clothing and pawns his clothing at night to get his bed, and the regular rate of interest is 75 per cent per annum. In Java, where conditions are somewhat similar, the Government has attempted to relieve the people by establishing Government pawn shops in which the interest rate has been reduced to 18 per cent. This provides a method by which statistics become avail-

able, and it is found that these pawn shops approximate one transaction per capita per year, the average amount involved varying between 60 and 80 cents (American). About 90 per cent of these pledges are redeemed, the remaining 10 per cent being sold. People living under such circumstances are in poor condition to resist infection, and malaria, tuberculosis, pellagra, and other debilitating diseases reduce their industrial value most seriously.

This subject could be extended indefinitely, but elaboration is not necessary. Suffice it to say that the poorer types of the working classes of Asia are an extreme type and can not be expected to show much intelligence in the care or handling of machinery, or to distinguish between the mechanical qualities of a watch and a steam hammer.

On the other hand it is possible to find good mechanics among these men. A Diesel engine calls for a superior sort of attendance, and many of these engines are operated successfully in stations from Colombo to Canton. Such operation so far from sources of repairs and supplies is a nice problem.

Repairs made in the Orient will usually be below standard and expensive. Repair parts purchased from the original manufacturers can not be secured in less than about four months—frequently double that time—and getting these is a great nuisance. The American manufacturer, in selecting types of machinery for use in Asia, should adopt those in which the problem of giving service is as simple as possible. Dependability should be emphasized at all times. Failures are very serious.

EFFECT OF CLIMATE ON MACHINERY.

Climatic conditions are bad at one time of the year or another practically everywhere in Asia. For weeks, in some places months, at a time the season is rainy and the humidity excessive. Leather gloves or shoes will get green with mold overnight. Book bindings deteriorate rapidly. Clothing will mildew inside of a trunk. Wall paper can not be used because the softening of the paste allows it to fall. Water will collect in drops on doors and walls and will accumulate on the inside of electrical conduits. Insulation for electrical apparatus, if not of appropriate materials, will fail. Equipment that would give perfect satisfaction in America may fail in Asia, and orders for these installations should specify "tropical insulation." The heat in many districts becomes intense at certain seasons, and allowances should be made when necessary, as in the design of condensers or humidifying equipment. The combination of temperature and humidity frequently destroys electroplating, causing it to peel. Painted or varnished surfaces deteriorate rapidly. As a rule, parts finished in brass will be found more satisfactory. There is an abundance of cheap labor in most districts, and it is the custom to keep these surfaces well polished. Unfortunately, when electroplating does not fail through peeling it is often destroyed through excessive polishing. A neat brass surface usually presents the better appearance. This endless polishing frequently obliterates the marking on name plates. Enamel or glass protected plates are more durable.

Tropical rains are very severe and frequent. A rainfall of more than 20 inches in 24 hours has been recorded in Ceylon and one of

36 inches in 24 hours at Baguio in the Philippine Islands. As the average annual rainfall in Chicago is only 33.3 inches, the sustained fury of such a storm may be estimated. It will never be appreciated until experienced. The penetrating and drenching power is marvelous, as these storms are often accompanied by high winds. Machinery installed inside of a corrugated iron building will probably receive a good drenching during such a storm. Machinery left in the open might almost as well be left under the stream from a fire hose.

Factory buildings and equipment sent to Asia should be wind-resisting; where practicable, this feature of the problem should be given consideration. There are several fairly well-defined typhoon or cyclone belts on the coast of Asia. At times the winds in these districts are extremely violent. The writer has in mind a storm in Formosa that stood a narrow-gauge locomotive on end. In other instances, all up the coast from Hongkong to Yokohama great damage has been inflicted. The larger part of the Philippine archipelago is exposed to these storms. Building specifications frequently allow for special wind pressure, and this introduces a problem in connection with international competition. Will the European manufacturer actually place sufficient steel in his building to resist these winds, or will he skimp his allowance and thereby secure an advantage? In order to determine just what velocities are experienced the writer consulted the returns of weather bureaus of Formosa (Japan), the Philippines, and Hongkong and found instances where the wind velocities went as high as 120 miles per hour, and in every case it is understood that the instruments broke down at that velocity, although it was felt that this did not represent the most extreme severity of the storm. The only helpful information secured beyond that point was at Hongkong where, in a report from the Royal Observatory on "The Climate of Hongkong," it is stated that "from the gradients observed near the center of some very violent typhoons the wind velocity has been estimated to reach 170 miles per hour."

Obviously it is not practical to construct a building to resist a wind velocity of 170 miles per hour, as this corresponds to a wind pressure of 116 pounds per square foot (dynamic, not static). Even 120 miles per hour represents 58 pounds per square foot and 100 miles per hour 40 pounds per square foot. Buildings for these pressures would be very costly. One designed for 20 pounds per square foot will withstand something over 70 miles per hour. In this connection the matter of frequency needs to be considered. Although, on an average, possibly 16 powerful typhoons reach the China coast each year, it is probably 30 years since a wind velocity exceeding 100 miles per hour was experienced in Manila, Hongkong, or Japan. The most violent typhoon experienced in Japan in recent years was in Tokyo on October 1, 1917, attaining a velocity of 88 miles per hour. As these velocities are reached so rarely, it is probably good engineering to design for pressures of about 20 pounds per square foot, realizing at the same time that the building will fail if it should get caught in the very center of one of the most severe storms. But in connection with design in general, machinery as well as buildings for locations within reach of the cyclones of the Bay of Bengal as

well as the China coast should have special attention. The combination of wind and rain sends water everywhere; even inside of buildings people find it necessary to use umbrellas, and equipment is in danger of a bad wetting. Fastenings for glass or corrugated iron, as on crane cages or railway cars and the like, should be especially strong.

EFFECT OF CLIMATE ON ELECTRICAL INSTALLATIONS.

Climatic and weather conditions, as described above, also have serious effects on electrical installations, as has been suggested. In some districts these and milder storms are accompanied by severe lightning, and when lightning is of tropical violence it will subject the protecting devices to a very severe test. Similarly, other electrical equipment should be carefully selected. The air temperature inside of a building in the Tropics is frequently very little below 100° F. The excessive humidity of the air will have a serious effect on the insulation. On the average, equipment is not installed with the care and thoroughness known in America, so that serious vibration may be anticipated. The labor available is commonly indifferent and unintelligent. All of these conditions are unfavorable and lead to unsatisfactory results, and because of them it is probably not wise to generate power in the average station at a tension above 2,200 to 3,000 volts. As has been stated, tropical rains are frequently excessively heavy and accompanied by high winds and abundant lightning. If the generator is connected directly to the transmission line, all the machinery, the switchboard, and the other equipment are subject to frequent discharges; experience indicates the probability of failure, and it will be difficult to arrange for satisfactory repairs. On the other hand, if step-up transformers are used, preferably oil-cooled, with reinforced insulation on the high-tension coils and effective lightning arresters connected on the line, and also if the machinery is grounded effectively, the probability of trouble of this sort is greatly reduced. Similar precautions should be taken with step-down transformers and motor or lighting circuits. A bare wire above the power wire, well grounded at frequent intervals, is also of assistance in protecting a transmission line.[1]

EFFECT OF CLIMATE ON BUILDING MATERIALS.

Wood is a very doubtful material and is often undesirable for construction work in the Orient. It is attacked by white ants, wet rot, dry rot, expansion from the dampness of certain periods, and contraction, checking, and warping from the extreme heat and dryness of other seasons. Under certain conditions it is attacked by borers. Buildings, bridges, and railway ties are sometimes destroyed very rapidly. Fence posts and telephone poles are often of steel or concrete. Such equipment as is used for drilling artesian wells should be of metal rather than wood.

Where surfaces are galvanized, this should be very well done, much as for marine fittings. Where paint or varnish is used it should be of very good quality, applied liberally.

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[1] See the following publications of the Bureau of Foreign and Domestic Commerce for further information regarding the markets for electrical machinery in these Far Eastern countries: Special Agents Series No. 172, "Electrical goods in China, Japan, and Vladivostok," and Special Agents Series No. 213, "Electrical goods in British India and Ceylon."

DESIRABILITY OF LABOR-SAVING DEVICES.

One of the most common errors made in selecting machinery for Asia is in connection with labor-saving devices. It is felt that labor is so cheap that it need not be saved. It is true that it is paid at a very low rate—40 cents per day, more or less, depending upon location and type. We are often told of its cheapness, but rarely do we secure satisfactory statements as to its inefficiency. It often requires two men to drive an automobile or carriage. It is unusual for a European to have less than 3 servants in his home, and in India he will have perhaps 17. It often happens that the labor cost of an article is higher than it would be in America. Japanese labor is probably superior to most other Asiatic labor for manufacturing, and Japan has made a serious effort to produce machine tools, yet those who seem to know assert that the Japanese can not produce a lathe of equal quality at a price to compete with the American product. In Java a good many Diesel engines are used that need new cylinder liners from time to time. The agents have large and well-equipped repair shops—a plant that will employ, say, 400 men and can pour castings up to 6 tons—yet these spare liners are imported from the European makers, as it is found that they can be secured at a more favorable price.

Because of the extreme inefficiency of Asiatic labor, well-informed buyers will invest heavily in labor-saving devices. Also, in many more districts than one might expect, there is a scarcity of labor. In offering machinery for use in Asia it is well to include labor-saving devices if they can justify themselves in America. From the sales manager's point of view it is wise to inform the buyers in Asia what economies can be effected with labor-saving devices and to offer the best designs obtainable. Although this policy will usually involve more selling effort, it will also be found wise. A good many years ago, in the installation of a hydroelectric plant in Kyoto, Japan, the first ever built in that country, the water wheels were not provided with automatic governors. Instead a coolie controls the gates by a hand wheel, regulating the voltage by watching the voltmeter needle. The writer has always found it difficult to understand engineering that adopts economies of this sort. Evidently the scheme was not a great success, as the practice has not been employed subsequently either in the above or other stations.

FUEL ECONOMY.

Fuel has become very expensive in Asia. In Manila, about 1913, coal cost about $4 per ton. In the spring of 1919 it was about $30 per ton. In Ceylon Indian coal cost about $5 per ton in 1914 and about $21 per ton in 1919. Similar results have been experienced quite generally. Wood and oil are also expensive in most industrial districts. Consequently steam economy is commonly more important in Asia than in America. This is a subject that calls for really good engineering, and unfortunately many of the installations in Asia, especially from European sources, are not good. It should be possible to raise the standards of boiler-room design and steam economy generally by the exercise of salesmanship, and, once done, these efforts should be

greatly appreciated.[2] There is a good opportunity to improve the engineering of Asia as related to fuel economy in both production and consumption of steam.

STEAM BOILERS.

Special caution should be exercised in sending steam boilers abroad, as in some of these countries there are local laws governing the construction and operation of any boiler or tank that is to be under pressure. Regardless of the merits of these rules, it is necessary to enforce them, and the little differences between European and American practice sometimes cause embarrassment. This should be remembered in connection with the exportation of road rollers, locomotives, hoisting engines, air receivers, and the like, as well as boilers alone, since the same inspection is in force. The writer has reports of one case where the working pressure on a battery of boilers was reduced 15 pounds (1 atmosphere) because the plating lacked the thickness required by the rule by only one-tenth of a millimeter. In another case the pressure on a battery of several thousand horsepower was reduced a like amount because certain joints were quadruple-riveted, a type of construction not contemplated by the local rule. In many districts spring-loaded safety valves are not admitted. Opposite page 255 is a photograph taken in the busiest part of Canton, showing what happens to the weight and lever type. Sometimes in place of the brick the lever is fastened in place with wire. The firemen seem to be annoyed by a valve that leaks. There are certain districts where this has become what might be called standard practice. Explosions do occur. The writer was told of a serious explosion on the Malabar coast in India which resulted from just this thing, and, moreover, it was a portable boiler that failed.

Although the Department of Commerce has copies of most of the boiler laws now in force in Asia, it is not quite safe to rely entirely on them, as these codes are being revised. In every case where such equipment is exported all parties concerned should have a very clear understanding as to just what inspection rules are to be applied. These remarks apply with especial emphasis to the Dutch East Indies, where there is the so-called "Java steam law," and to British India, where, at the moment, each Province has its own set of rules, but where efforts are being made to adopt a uniform code. Usually the inspector in Asia wishes to be assured that the boiler has been made of appropriate materials and under proper inspection, and it will ordinarily facilitate matters very much if suitable certificates are sent forward. Also, if the boiler is insured for a year it demonstrates to the inspector that the boiler is offered in good faith and at least conforms to American standards, which are recognized abroad as being pretty good. It is strongly recommended that spring-loaded safety valves be used whenever they will pass inspection. The photograph explains why, but if laws require the dead-weight type it becomes necessary to comply.

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[2] This subject is treated more fully in connection with the reports on the several countries, and those who are especially interested can secure further data through specific inquiries sent to the Bureau of Foreign and Domestic Commerce. Basic costs to users fluctuate rapidly, and fluctuations in exchange have been wide and rapid, thereby adding a further disturbing factor when calculations are made in American money. But no matter how far this complicated subject is analyzed it comes back to the conclusion stated above.

MISCELLANEOUS FACTORS AFFECTING SALES POLICY.

BANKING AND TERMS OF PAYMENT.

Certain manufacturers have asked for information regarding banking facilities in Asia. Much has been written about the credits extended by Germans in pre-war days. As applied to transactions in factory machinery the matter is simpler than for other merchandise of a more staple nature, as these usually represent investments in fixed plant as distinguished from a merchant's inventory. Practically all of this machinery is sold through agents or importing merchants in the different cities abroad. From the nature of their business it is necessary to keep their capital turning as rapidly as possible, probably once in 60 days or less. It is customary for the American export merchant when shipping such equipment to finance these exports through an exchange bank, sending the draft forward attached to the bill of lading (and other documents) through that bank. Usually on selling his draft to the bank the merchant can pay the manufacturer in full, and from that point of view his interests are satisfied. However, at destination the exporting merchant needs time to collect from his customer. During the war some manufacturers required that orders be accompanied by an irrevocable credit. It will be plain that this imposes a real hardship on the merchant in Asia, as that amount of his capital is tied up and inactive possibly for months. Although this procedure is safe enough, ordinarily it will not be found practical in normal times.

Sometimes the draft is D/P (documents against payment). In this case the bank holds the shipment as security until actual payment is made. Unfortunately, this also does not satisfy the importer, who wants to collect from his customer, if possible, before he himself needs to settle the account.

If the manufacturer covers a given territory through a merchant firm as agent, he has very little occasion to worry about terms of payment, provided his agent has an American office, as that office will finance the shipments, but if the agent has no office in America it then becomes practically necessary for the manufacturer to absorb in his own organization the duties of the export merchant, which include financing the shipment. Under these conditions it is not only legitimate but almost necessary to increase the selling price enough to correspond to the charges of the export merchant, which for machinery transactions will approximate 2½ per cent. Under these circumstances it will also be necessary to decide what form of draft will be issued. Normally the agent overseas will want it drawn D/A (documents against acceptance) 30, 60, 90, or more days. As the exchange banks require two names on all such paper, it is clear that the manufacturer is accepting a real responsibility if he concedes this point, which will usually be necessary; this demonstrates one of several reasons why the agent should have an American office.

It is in this connection that certain criticism is directed at the banks. If a manufacturer is to extend credits to importers in Asia, he commonly can get his credit information only from the banks, which in turn always refuse to extend the credit they recommend because of this two-name rule—yet this is the general attitude of the exchange banks.

However, it is not recommended that manufacturers engage in unbusinesslike practices, nor is it to be inferred that European manufacturers do so. On the contrary, if it is found that liberal terms are extended, most probably some safe method has been developed. It is not possible to take up here the various methods followed, but one example will serve as an illustration.

USING THE BANK TO ASSIST IN MAKING SALES.

In some countries there are discount banks (not to be confused with the exchange banks). If a buyer wants a very long time in which to pay and the importer agrees, the transaction is followed in the usual way, except that on delivery the buyer issues an acceptance to the importer, which the bank discounts. In this way the manufacturer, exporter, and importer are all paid in full and the transaction stands in effect as a loan from the bank to this buyer. When the acceptance is discounted "without recourse," the bank has full responsibility, but this is seldom done and the importer's name is commonly on the acceptance throughout its life.

In some places people speak of discounting "del credere," which at first suggests that the acceptance is "without recourse," but there are certain supplementary clauses that restrict this very much.

Almost everywhere in Asia one can find plenty of banks to enable him to take care of ordinary exchange transactions. It is true that there is probably plenty of room for more competition. Sometimes the existing banks seem somewhat arbitrary. There is a great shortage of discount banks.

From the above it is plain that the manufacturer has few responsibilities if he sells "cash against documents f. o. b. factory" or even "cash against documents f. a. s. New York" (or equal), but as soon as he undertakes to quote "c. i. f. Asiatic port" he needs men in his organization who understand the meaning of all these and other terms and can distinguish clearly between the responsibilities of railway, stevedore, steamship, insurance company, and consignee and also appreciate clearly the differences between the different kinds of insurances "f. p. a.," "w. a.," "all risks," "war risk," etc.

But there is another angle to this banking situation that is of great importance to American manufacturers of machinery, and that is the influence of nationalism and investment banking in controlling the competition for business. Probably 90 per cent of the railways of China are forced to buy their materials in markets that are inferior to those of the United States because these roads were built under foreign loans, the agreements for which stipulate that purchases shall be made in the lending country.

The principle applies to other countries as well as China and to industries and mines as well as railways. Frequently where European capital is employed it has been very difficult for American manufacturers to supply the equipment, even though they might

offer better goods at a cheaper price. But, in the future, it will probably be even more difficult. The war has intensified nationalistic feeling everywhere. There is a tendency for manufacturers, merchants, banks, and diplomatic services of the several countries to coordinate their efforts along nationalistic lines, and this, of course, implies a certain discrimination against outsiders. Unquestionably Americans are at a disadvantage in these matters. Regardless of what views we may have as to the unwisdom of such a strongly nationalistic policy on the part of others, American business is still forced to depend upon foreign banks very commonly even for routine services. Obviously it is simple wisdom to encourage American banks in their foreign efforts. Also, now that the United States is a creditor nation, it will be desirable, if not necessary, for us to invest large sums abroad. The American manufacturer of industrial machinery has a very active interest in having these investments so made as to stimulate his business, as has already been indicated on page 37.

European countries have engaged in the "peaceful penetration" of various districts through coordinating the activities of diplomatic services, railroads, and banks, and while the present writer does not in any way recommend this method for the United States it will undoubtedly assist American diplomats and interests generally if our manufacturers will take a more active interest in these problems. It is at this point that business, banking, and world politics mingle. The subject becomes involved and will not be pursued further here, although it is of absorbing interest.

PATENTS, TRADE-MARKS, AND COPYRIGHTS.

In all the countries of Asia there is a tendency toward the copying of designs, the pirating of trade-marks, the imitation of labels, containers, etc., as well as other abuses from which manufacturers wish to be protected. The laws covering these matters are not so well developed as in many other countries, but in most instances there is a certain amount of legislation whereby patents may be issued and trade-marks and copyrights registered. Flagrant disregard of the various laws is exceptional, and manufacturers should arrange for appropriate protection before establishing a line of products in these markets.[1] This must be done according to the laws of the several countries, and it is necessary to be very punctilious in conforming closely to all details so as to comply not only with these foreign laws, but also to keep within the practices of foreign jurisprudence.

In some instances unauthorized parties apply for the registration of American trade-marks for speculative purposes—a procedure that may prove profitable in those countries that base ownership of marks on priority of registration regardless of prior use by another. When these fraudulent registrations are secured it is practically equivalent to the acquisition of an exclusive agency for the products involved unless the manufacturer is willing to adopt a new trade-mark for

[1] The Bureau of Foreign and Domestic Commerce has collected a great deal of information on this subject in the Foreign Tariff Division and can supply, on request, information and advice on specific problems.

that particular market, and this in turn usually involves the sacrifice of good will that may represent a great deal of expensive advertising.

A similarly embarrassing situation develops sometimes when it is found that registration has been made in the name of the local agent or importer. As long as the agent is satisfactory there are no complications, but when the principal wishes to make a change the agent may have the power to prevent the importation of the protected goods, unless it be done on terms he may dictate. During the war similar complications arose where the agent's name was placed on the enemy trading list, as happened in some instances. Agents should be instructed to obtain registration in the name of the principal.

When an agent is a man of integrity and dependability he can often be of great service in matters of this sort, but ordinarily it is a legal matter and should be handled by competent attorneys. Also it should be remembered that these rights will not protect themselves, and the manufacturer should be prepared to resort to litigation should this be necessary. This must be conducted under the laws of the foreign country involved, and the case must be handled in accordance with the alien procedure. One should be very careful to handle these matters so as to be sure of having a good case at court if litigation should be necessary.

PLANNING A TRIP TO ASIA.

NECESSITY OF ACCURATE INFORMATION AND PROPER CAUTION.

Those who are considering their first trip to the Orient seem to find it difficult to plan intelligently. If the individual is of a methodical turn of mind, there is a temptation to work out an itinerary for months in advance; but this is not wise if arrangements make it necessary to adhere closely to such a schedule, for the unexpected frequently develops and usually it will be found that an oriental trip requires much more time than is anticipated, for the traveler should usually allow a good deal of time in which to get an understanding of each new country. Conditions in Java or China or any of these other countries need to be seen to be appreciated and will usually require thoughtful study on the ground in addition to what can be learned by reading, though, of course, a trip to Asia deserves a good deal of related reading.

People who are rather impulsive sometimes fail to give sufficient care to their plans, and in Asia it is amusing to observe the things that happen to such individuals. For example, in Calcutta there are 13 successive holidays early in October. Allowing for the demoralization preceding and following this celebration, one landing there about September 20 is very apt to waste an entire month in expensive surroundings.

But matters can easily become even more serious. By reaching certain districts in the very hot or rainy season one can come near wasting his time and money altogether. In 1919 there was a war on the Afghan border of India, followed by a peace conference at Rawalpindi, in northwestern India. These negotiations were conducted, to a very large extent, on days when the thermometer went above 120° F. That may be all right when really necessary, but

one should endeavor to find a better season in which to conduct ordinary business if it is reasonably easy to do so. In Calcutta, Bombay, and other business cities of India the temperature rises above 110° F., with high humidity. It is not true salesmanship to attempt to do business in the hot districts of India during the "hot weather." One should not arrive before September, nor stay after February. This matter is of such great importance that one's entire trip should be planned with this feature foremost.

AVOIDANCE OF EXCESSIVE HEAT AND POSSIBLE INFECTION.

The very hot season is also commonly the season when there is the greatest danger of infection. It seems to be agreed among qualified physicians that the white man can travel anywhere and work hard in any climate, provided he is protected from infection, but the conditions in most of these countries make it very difficult to escape. At any time of year in the entire area between Yokohama and Port Said one should avoid uncooked food and drink and by so doing will probably escape that long list of enteric diseases, some of which are very dangerous and all of which are at least a serious inconvenience. As mosquitoes carry malaria, dengue, and probably a number of other fevers, they should be avoided to the greatest practicable extent. Ordinarily by the exercise of a little care a trip through Asia can be made very pleasant and is to be strongly recommended as a splendid experience. It is not a matter of laziness or softness, but it is good business to visit these countries at those seasons when work is easiest and effort and traveling expenses are invested to the best advantage. It is not a matter of endurance of the traveler, but rather a matter of good salesmanship, to visit customers when they are under favorable conditions.

In the above emphasis has been placed on the discomforts of hot weather, but at the other extreme, winter will be found very severe everywhere north of Shanghai, except that the largest cities in Japan are not really cold, though as most of the buildings are inadequately heated, work there often becomes difficult. The writer has suffered more from the cold with the thermometer above freezing than when it was lower, and it is not entirely a matter of dress, for one sometimes feels disposed to put an overcoat on in the house and take it off for a walk in the street.

SUMMARY OF CLIMATIC CONDITIONS IN PRINCIPAL LOCALITIES.

Remembering that a trip should be so planned as to avoid India between March and September, and adopting the principle that one can work to the best advantage when comfortable, the following particulars have been prepared to assist in planning so extensive a trip as one to Asia so as to derive the greatest advantage from the investment. Apart from time, salary, entertaining, automobile, etc., an eight months' trip to Asia will probably cost between $3,500 and $5,000—an investment that should be made with care.

Calcutta.—November to March: Cool and pleasant. April, May, and June: Hot; very hot. June to October: Humid and uncomfortable.

Bombay.—November to March: Cool and pleasant. May and October: Hot. June to October: Rainy and hot; travel difficult and unpleasant.

Rangoon.—November to March: Cool and pleasant, March to September: Hot and rainy. Rangoon gets about 90 inches of rain per year—about three times as much as Chicago.

NOTE.—In India it is inadvisable to pay business calls on mail day, which means Friday and Saturday in Bombay, Thursday in Calcutta, etc. Also, calls should not be made before 10 a. m. or after 4 p. m., or at tiffin time between 12.30 and 2 p. m. In making an itinerary plenty of time should be allowed for India.

Colombo.—A delightful spot that may be visited at any time. The temperature is never above 92° F. nor below 65° F. February, March, and April are the hottest months and August the coolest. May, June, July, September, October, and November each have more than 17 days with rain per month. Colombo is best in December and January. The northeast monsoon breaks between November 1 and 15. The southwest monsoon breaks between May 10 and 20.

Singapore.—Also a delightful place that can be visited at any time. March is apt to be the hottest month, with a record of 92° F. as the maximum. November is the coolest, with a record of 73° F. as the minimum. Humidity is highest in December and lowest in April. Rain is rather evenly distributed, but heaviest in January and lightest in May—176 rainy days per year, totaling 130 inches, about four times as much as Chicago.

Batavia and Java.—The temperatures are very uniform. In Batavia the warm months are May and October, with a mean temperature of 79.5° F. Cool months are January and February, with a mean of 77.6° F. Rainfall is 72 inches per year, 70 per cent of which falls between November and March. August is the dryest month, having only three to five days with rain. Other parts of Java differ somewhat. The best season is April to October, which alternates nicely with the season one should devote to India. Business conditions in Java and the other islands of the archipelago differ very much from those in India and China, and plenty of time should be allowed for studying them.

Indo-China and Siam.—Haiphong and Hanoi are reached most easily from Hongkong or, once a month, from Manila. Bangkok is reached best from Singapore; the most comfortable way is by water, leaving Saturday and arriving Wednesday. The trip can be made by rail in five days, involving a stopover of nearly a day at Penang and a night each at Alor Star, Tung Song, and Chumphon. The rail trip is tedious and uncomfortable. The weather is controlled by the monsoon, which is very regular, the variation being within one or two days. The best season is during the northeast monsoon, October 15 to April 15, when the temperature is 78° F. to 80° F. by day and 68° F. by night in Saigon. During the southwest monsoon, April 15 to October 15, there are daily rains, and tornadoes occur. The temperature is about 84° F. day and night. April and May are the hottest months, from 86° to 93° F., with high humidity.

Manila.—Seventy-five per cent of the rain falls between June and October, and the period is cloudy. July, August, and September have 21 rainy days per month. From May to September there are many severe thunderstorms and typhoons. February, March, and April are the dryest months (three rainy days per month). January is coldest, at 77° F. mean temperature. May is hottest, at 83.4° F. mean temperature. The hottest record is just over 100° F. Hot season, April, May, June; cool season, November to February; intermediate season, March, also July, September, and October. Humidity low in April; high in September. Can be visited any time of year, but most comfortable from January to April.

Hongkong and South China.—December to March 15 is a cold, dry winter; the lowest temperature ever recorded was 32° F.; the mean January temperature is 60° F., and the thermometer may go up to 75° F. or 80° F. Dress is a problem under such conditions. Spring—March 15 to May—is damp, misty, cloudy, and unpleasant. Summer—June to September—is hot and trying; mean temperature, 83° F., highest ever recorded, 97° F. Early summer is cloudy and rainy, the precipitation decreasing later. Autumn—October and November—is a pleasant season and best suited for a visit.

Shanghai and North China.—Summer is hot and unhealthful, July and August being very trying and June and September difficult at times. Winter is correspondingly cold, going to 12° F. in Shanghai and much lower in the north. January and February are the coldest. October and November are the most

pleasant months. March, April, and May are spring months not unlike those in the United States, except that dust storms may be encountered in the north, where the climate is dryer than in most sections of America.

Japan cities.—About June 15 the 20-day rainy season starts, which is followed by heat until September 15. From then until Christmas there is ideal autumn weather. From Christmas until about January 4 there is a series of holidays that make business difficult. From January until March 15 there is an unpleasant winter season. Between March 15 and June 15 there is a delightful spring, somewhat more rainy than the autumn.

CLOTHING.

It is customary to dress for dinner everywhere from Yokohama to Suez and beyond. A gentleman will require both full dress and dinner coat, white tie and black. A lady will probably need three evening dresses as an absolute minimum, and most women will feel that they want more. It is necessary to conform to these customs. In the hot weather a sun hat is worn in all of these countries and with it a suit of white duck, pongee silk, or equal. As these require frequent washing, one will probably require at least a dozen suits if traveling so as to be beyond the reach of a laundry for several days at a time. Such clothing can be purchased quickly and cheaply in all of the more important cities. Other clothing will be found expensive.

On the map opposite page 1 will be found a table indicating roughly the amount of time required to travel from city to city on the usual steamers. Trunks weighing more than 200 pounds are apt to receive an abnormal amount of damage. As the methods of handling baggage usually follow European as distinguished from American methods, it is ordinarily wise to restrict the weight to even lower limits.

ESTIMATING THE VALUE OF ASIATIC MARKETS.

From the data given in the tables on page 6 and also on page 3 and in other parts of this report it is plain that Americans have an interest in these machinery markets that may be estimated at $50,000,000 to $70,000,000 per year. It has also been shown that these markets are growing and that there is very good reason to expect them to grow. Consequently they are far too important to be neglected. On the other hand, it is not wise to overvalue them as is sometimes done. The following amusing paragraph is quoted from "British versus Germans in China," page 73:

> It takes very little to influence people one way or another, and the writer knows of an actual incident which seems to illustrate the case in point. A certain American manufacturer of shaving soap suddenly came across the fact that there was a population of 400,000,000 souls in China. Probably he acquired the information from his morning paper. At all events he wrote his agent in China asking why orders had not been sent for about 200,000,000 shaving sticks and at the same time terminating his agency agreement, little realizing that not one Chinaman in a thousand has the means or inclination to treat himself to a perfumed shaving stick.

The writer has had similar experiences, and this failing is not at all peculiar to Americans. The purchasing power of human beings earning less than 30 cents per day and clothed with less than 25 cents' worth of apparel will not absorb many shaving sticks, although these people exist by the millions. On the other hand, if their condition can be improved so that each has a 50-cent wardrobe they may require an astonishing number of additional spindles and thousands of horsepower in first-class American-made cotton mills.

Asia is backward and handicapped in numberless ways. For centuries efforts have been made to open these countries up. For decades people have tried to install railways, telegraphs, and industries, and it has been difficult and tedious work. But, as pointed out in discussing advertising, very important progress is being made.

The value of these markets should be studied calmly and organization for work in them established with practical deliberation. It is not to be concluded from what has been said that Hankow will become a Pittsburgh in a decade, let alone over night. Bombay and Osaka, with their tremendous spinning mills, will be a very long time in rivaling Manchester. Notwithstanding this, a really important opportunity does exist and good managers will take advantage of it. In fact, this is the crucial time in Asiatic trade. The markets should be adequately worked, but not on the basis of an overestimate of their purchasing power.

This problem is not new but has existed through all the centuries of trade with the Orient. From the beginning, and practically at all times, the too eager trader has netted losses, while probably at the same time more careful managers have amassed fortunes. In the period 1845–1850 an investigation by the British House of Commons disclosed that the whole China trade was being conducted at a serious loss and yet was carried on year after year in a "hope-on-hope-ever" spirit. And again regarding the same period it is written: "Every traveler in every port of China is astonished at the quantity and variety of merchandise which is constantly on the move. It is this that inspires confidence in the boundless potentialities of Chinese commerce, which seems only waiting for the link of connection between the resources of the Empire and the enterprise of the western world."[2]

The Empire is now a Republic, but the old problem remains. Decade after decade we have seemed to be on the verge of that boundless expansion, yet ever, like the gold at the end of the rainbow, it is still before us. And the case applies not only to China but to all Asia. Always the overzealous person has overdone the matter and failed. It is remarkable how few of the merchant firms are really old and how few of the names of the firms of by-gone days remain.

PAST GROWTH OF ASIATIC TRADE.

But there is another side to this story, for, simultaneously, other merchants have prospered wonderfully. This same Anglo-Chinese trade that has for so many decades caused men to "hope on, hope ever" for the promised development shows the following growth in British exports to China:

1842	£1,500,000
1852	2,500,000
1861	4,500,000
1900	7,000,000
1907	12,600,000
1910	9,450,000
1913	14,600,000
1917 (war year)	11,000,000

[2] "The Englishman in China," by Alexander Mitchie, published in 1900, vol. 1, pp. 172 and 209.

Although this business is not large as such things go, it shows creditable and reasonably consistent growth, and every other country in Asia could probably show equal or better proportionate development. Nothing is to be gained by exaggerating or disparaging the possibilities, but we have long known of the "China merchant" as a prosperous type of man, and, if handled on a businesslike basis, trade in these markets is profitable and increasingly important.

It should be remembered that development usually accelerates, and in view of the new spirit that has spread over the Orient, the desire for industrial development described above, it is very probable that this development will be abnormally rapid during the next few years. Enough has already been done in establishing railways, textile mills, mines, electric power plants, sugar centrals, steel mills, blast furnaces, shipyards, and a great variety of factories to cover the pioneer stage. Asia is now ready for the development stage and may be expected to repeat upon a large scale the boom experienced by Japan after 1904, following the Russo-Japanese war.

PRESENT STATE OF ASIATIC MARKETS.

In the ensuing sections of this report an effort is made to give a picture of the industrial development of each of these countries, with a view of showing their value to the American manufacturer of machinery. To do this, it is necessary to use data secured from a great many sources. It is hoped that the limitations of these returns will be appreciated. Particulars indicating the area, the population, and the population per square mile are of value, but, as has been indicated, it is necessary also to consider the development of the people and the development of the territory. New Guinea is large, fertile, blessed with good soil and population, but is poor as a market. It has neither railways nor highways to any adequate extent, and the people are as undeveloped as the country. Borneo is in a similar plight. Even when there are transportation facilities they are inferior to those known in America. Even when there is adequate population, the individual purchasing power and working power are very low. China is reported to have four times the population of the United States, but certainly has not the capacity for production that is found here. It has been estimated that the power employed in industry in that part of the United States between Washington, D. C., and Boston, Mass. (the superpower zone), is equal to the producing capacity of more than 3,000,000,000 slaves. China has never possessed any such helpers. Although the writer has great admiration for the industrial capacity and economic efficiency of the individual Chinese, it is only right to add that he still falls short of the American in these respects.

Similarly, it has been necessary to use the trade statistics as publishel by the customs authorities of the different countries. These figures are very useful and valuable, but have their limitations. They are compiled from the invoices accompanying each shipment by men who can have only a limited knowledge of the many commodities they are required to inspect. Questions of classification are sometimes very difficult. If a steam boiler is shipped as part of a sugar mill, it may easily be classed as "sugar machinery." In comparing the statistics of two different countries, it is not to be ex-

pected that they will agree. Apart from the problem of classifying each given shipment, as mentioned above, there is the question of meaning of words. For example, it is said that the expression in the German language corresponding to "machine tools" embraces not only those machines we include in that classification but also most metal-working machinery, woodworking machinery, stone-cutting machinery, and other items. In addition to these difficulties, some countries use the calendar year and some an arbitrary fiscal year. Also, goods recorded as exports from Europe or America in December would not be entered in the imports of a Far Eastern country until some months later, certainly in the following year. Goods are commonly entered as from the country of the last port of shipment, but frequently they have another origin. The Chinese returns for 1919 acknowledge receiving 1,144,222 Haikwan taels' worth of textile machinery from Canada and only 800,128 Haikwan taels' worth from the United States. Probably all of this machinery was manufactured in the United States, the shipments sent via Vancouver being credited to Canada. American machinery transshipped in the United Kingdom, the Netherlands, Hongkong, or Singapore would usually be credited to those countries on arrival in China. Also, there are times when some foreign customs authorities apply arbitrary values. For instance, in the Dutch East Indies an automobile is valued at about 3,000 guilders, regardless of its actual value. This simplifies the collection of duties, but in the annual returns the importation of a thousand cars would appear as, say, 3,000,000 guilders, while on comparison with the American returns it might appear at two or three times that valuation.

It is not wise to be too positive about conclusions derived from these sources of information, as they are subject to criticism as indicated, but, on the other hand, they have a very definite value. If one is interested in air compressors and Japan acknowledges having received 1,000,000 yen's worth in a given year, those compressors, of whatever type or origin, were delivered, and a foreign sales manager would be justified in planning his work accordingly.

Other discrepancies between the returns of different countries arise from the fact that they are usually valued at port of export on the f. o. b. value and at port of import on the c. i. f. value. The rates of exchange employed are also frequently arbitrary and may often differ a great deal from the banker's rate for the day.

The following sections of this report have been prepared to show the present and prospective development of each of the several markets for American machinery in that part of Asia covered by this investigation. The circumstances of the case require that these markets be considered as separate countries, but in reality the separate markets are the different cities. India is in reality five different markets. In the table on page 6 an effort has been made to show the comparative value of these various markets. That table also demonstrates a most astounding growth in the 1915–1918 period. Information as to the way that growth has been sustained, together with further and more recent details, will be given in the following pages.

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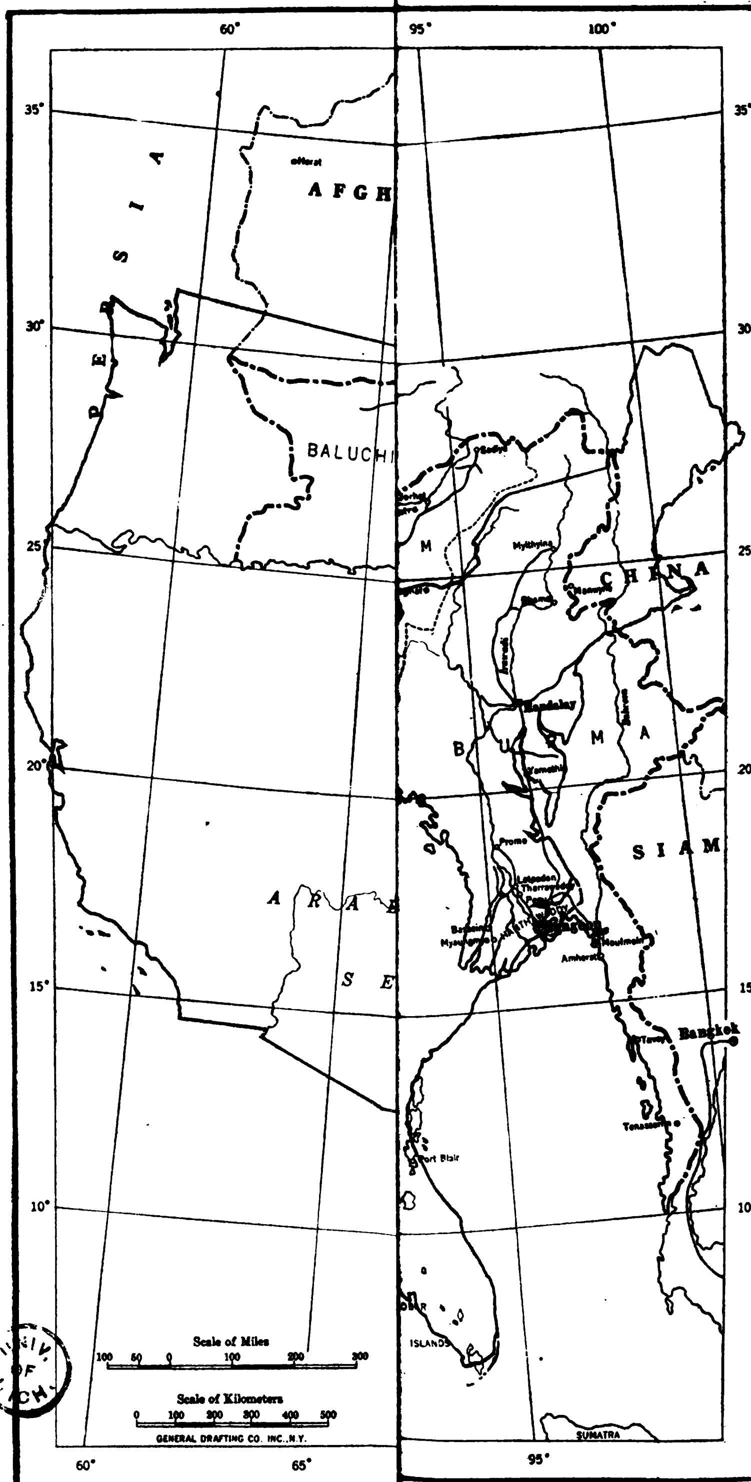

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INDIA.

EXTENT AND GENERAL CHARACTERISTICS OF THE MARKET.

American interest in the machinery markets of India in the past may be summarized in the following figures from the Indian customs returns, showing the imports of machinery to British India:

Years.	Total imports.	Imports from the United States.	Percentage from United States.	Years.	Total imports.	Imports from the United States.	Percentage from United States.
1913-14.....	£6,076,606	£112,170	1.8	1917-18.....	£2,579,292	£490,590	19.0
1914-15.....	5,304,650	123,659	2.3	1918-19.....	3,258,240	798,198	24.5
1915-16.....	3,882,306	152,075	3.9	1919-20.....	8,652,879	2,531,968	29.3
1916-17.....	3,297,580	206,373	6.2	1920-21.....	21,004,032	3,463,640	16.5

American manufacturers have a very distinct interest in any market that absorbs $102,000,000 worth of machinery in a year. The interest is intensified when it appears that $16,850,000 worth of this machinery was American. The interest increases further in a country where American participation advanced from 1.8 to 29.3 per cent in the short space of seven years. American machinery shipments have multiplied over 30 times since 1913.

The machinery business of India is not new. The cotton-mill industry was started there in 1851; the railways date from about 1853. For many decades the country has been developing industrially in a solid businesslike sort of way, and the situation as of 1917 was as follows:

Kinds of establishments.	Number of establishments.	Number of employees.	Kinds of establishments.	Number of establishments.	Number of employees.
Cotton spinning and weaving.	284	282,297	Sawmills.....................	127	11,672
Jute mills.....................	75	264,373	Woolen mills.....................	20	11,152
Cotton ginning and pressing..	1,775	133,323	Sugar factories.....................	40	9,847
Railway and tramway workshops.....................	97	115,529	Oil mills.....................	138	7,757
Rice mills.....................	542	47,114	Others.....................	1,549	265,802
Engineering workshops.......	161	39,112	Total.....................	4,827	1,238,410
Arms and ammunition.......	17	33,287			
Iron and steel producing works.....................	2	17,145			

India ranks sixth among the cotton-spinning countries of the world, being exceeded in number of spindles only by England, the United States, Germany, France, and Russia. It has more spindles than Latin America, China, and Japan combined. In jute it has practically a world monopoly. It has a larger acreage devoted to sugar than any other country in the entire world. Also, it has been

estimated that India produces 40 per cent of the world's supply of rice and is the world's greatest exporter of this commodity. The iron and steel industry has not yet become large, but seems to be established on a business basis. It is said that pig iron has been produced at prices that make it possible to market it competitively in San Francisco, and the original plants are rapidly being followed by several others. These particulars are submitted merely to indicate that India has been an important market for machinery for a long time. No list of industries or description can adequately describe the possibilities of this territory.

NEW POLICIES ENCOURAGING INDUSTRIAL DEVELOPMENT.

Although the above particulars are important, there have recently developed changes in the policies of those in control that are of far greater importance. Up to about 1905 there had been no considered and general policy on the part of the Government in encouragement of industry if we except railway encouragement, etc., but at that time a Department of Commerce and Industry was established. In 1907 a conference at Naini Tal resulted in certain efforts being made in the direction of employing Government aid in developing certain industries, and from time to time other similar enterprises were suggested. In connection with one of these in 1910 Lord Morley, as Secretary of State for India, wrote that the results of the attempt to create new industries were not of a character to remove his doubts as to the utility of State effort in this direction. But "the attitude of Government did not satisfy the important section of Indian public opinion which desired the industrial regeneration of the country. The revisal of the policy enunciated by Lord Morley was frequently demanded, and the success of Japanese industries, brought home forcibly to India by a very large increase of Japanese imports, was cited as an instance of what a previously backward Eastern nation could accomplish with Government encouragement."[1]

The outbreak of the war drew forcible attention to the extent of India's dependence upon countries outside the British Empire, particularly upon Germany and Austria, for the supply of many of the necessaries of life for its people, and some time after the commencement of the war the Government of India resolved to examine the question of the industrial policy which the Government should pursue in the altered state of things in India. In their dispatch to the Secretary of State, dated November 26, 1915, the members of Lord Hardinge's Government put the case for a change of policy in very clear and forceful language. They said:

> It is becoming increasingly clear that a definite and self-conscious policy of improving the industrial capabilities of India will have to be pursued after the war, unless it is to become more and more a dumping ground for the manufacturers of foreign nations who will be competing the more keenly for markets, the more it becomes apparent that the political future of the larger nations depends upon their economic position. The attitude of the Indian public toward this important question is unanimous and can not be left out of account * * *.

[1] "Report of Indian Industrial Commission," 1916–1918, p. 80.

Finally the Government said:

After the war India will consider herself entitled to demand the utmost help which her Government can afford, to enable her to take her place, so far as circumstances permit, as a manufacturing country.[2]

This policy appears to have the support of public opinion not only in India but in the United Kingdom, both private and official, technical and financial, and the change is so comprehensive that India of to-day is pursuing not at all the same business policy that it was before 1914. The country is aroused and will, undoubtedly, develop very rapidly and, in developing, will require industrial equipment in large quantities and in much greater variety than could have been anticipated only a few months ago.

The first systematic study of the productive possibilities of industrial India was made in 1917–18 by the Indian Munitions Board, which was organized to determine "whether more could not be done to develop Indian resources for war purposes, so as to relieve the United Kingdom as far as possible from the necessity of meeting extraneous demands."[3] This board accomplished a great deal and in reality laid the foundation for scientific development by planning for the establishment of key industries first, to be followed by the development of related industries subsequently. In this work the entire Indian Empire was studied in an effort to discover supplies of the various raw materials. Very important progress has resulted.

About the same time, May 19, 1916, the Indian Industrial Commission was appointed and has made a very comprehensive study of the entire problem.

The experience of the war itself has been responsible for a new attitude on the part both of Government and of leading industrialists. They realize that it is necessary to create in India the manufactures that are indispensable for industrial self-sufficiency and for national defense, and that it is no longer possible to rely on free importation of essential articles in time of war.[4]

The work of the Munitions Board and of the Industrial Commission have been coordinated and a definite plan of industrial development worked out. This growth has taken place at the same time that the new political organization of India locally known as the "reform scheme" has been established. The fundamental principle in the new Government system is provincial autonomy. Consequently the development of industries was delegated to the provincial governments, and in each a director of industries has been appointed and suitable organizations are being developed. These new departments are collecting data relative to the development of old or the establishment of new industries. They are provided with an increasing staff and are a very powerful influence, although they are still very new, and it will be some years before their greatest effect will be apparent. The nature and importance of new enterprises actually promoted during recent years can be noted from the following record of new

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[2] Note by the Hon. Paudit Madau Mohau Malaviga, published on pp. 314, 315 of "Report of Indian Industrial Commission," 1916–1918.
[3] Indian Munitions Board, "Industrial Handbook, 1919," p. 1.
[4] "Report of Indian Industrial Commission," 1916–1918, p. 122.

companies incorporated in British India, Mysore, and Baroda in the fiscal years ending March 31:

[Values in thousands of rupees.]

Kind of enterprise.	1913–14		1917–18		1918–19		1919–20		1920–21	
	Number.	Total authorized capital.	Number.	Total authorized capital.	Number.	Total authorized capital.	Number.	Total authorized capital.	Number.	Total authorized capital.
Banking and insurance	129	73,769	46	130,075	33	8,758	91	830,165	108	256,245
Navigation	5	8,520	2	900	1	45,000	9	212,500	6	21,500
Railways and tramways	6	25,800	3	2,800	......	....	......	....	1	39,000
Shipping, printing, and trading	121	528,569	116	84,012	153	74,709	497	860,645	557	466,578
Cotton mills	12	8,375	4	8,200	6	38,325	40	234,075	46	194,550
Jute mills	3	5,596	2	10,000	......	....	10	53,800	1	15,000
Wool, silk, hemp, etc.	1	150	1	100	......	....	9	61,350	4	4,600
Cotton and jute presses	5	720	5	1,400	4	1,425	11	18,850	21	24,900
Paper mills	2	75	1	2,000	1	1,400	......	....	4	3,200
Rice mills	4	396	1	20	3	9,075	18	8,475	22	27,473
Flour mills	3	1,050	......	....	......	....	6	3,850	2	1,000
Saw and timber mills	1	150	1	200	1	250	......	....	5	1,620
Other mills and presses	7	1,180	4	12,210	6	1,400	24	18,700	21	14,650
Plantations	27	5,780	43	12,514	34	8,290	92	41,397	37	31,175
Coal mines	7	1,695	18	6,650	26	9,725	48	31,145	28	29,250
Other mines	8	4,950	8	23,350	14	8,625	22	210,870	18	44,075
Land and building	4	700	4	10,160	2	695	15	85,800	28	81,320
Breweries	......	....	1	688	2	172	......	....	......	....
Ice manufacturing	4	870	1	60	......	....	1	150	5	2,620
Sugar manufacturing	2	505	......	....	3	4,900	5	5,525	13	64,400
Others	5	303	15	16,716	1	6	7	78,050	38	134,511
Total	356	669,153	276	322,055	290	212,755	905	2,755,347	965	1,457,667

The importance of this new growth in India is also appreciated in the United Kingdom, and the data in the following statement, showing the amount of new capital issued in London for enterprises in India and Ceylon, indicate the sincerity of those supporting the new arrangement:

Six months ended June, 1920	£1,514,000
Six months ended December, 1920	3,513,000
Six months ended June, 1921	14,638,000
Six months ended December, 1921	14,904,000

This increase in the amount of London capital so invested is most significant as expressing the actual development of the new policies. It should be noted that £14,000,000 (say $60,000,000) is a very considerable sum to float in any market at any time on behalf of relatively small enterprises located some 8,000 to 10,000 miles away. Also, the London market has not been an easy market during the above periods. There is something very substantial about the new industrial program in India which should be of very great interest to American manufacturers of machinery in view of their participation in the supply of industrial machinery as shown in the first paragraphs of this chapter.

GOVERNMENT AID TO INDUSTRY.

From the foregoing it is clear that the business and official communities are committed to a policy of industrial development for India. The nature of the aid extended by the provincial govern-

ment is, ordinarily, along the lines of scientific research, the loan of experts, the collection of data, and technical assistance for advice, research, or maintenance. The central government is also maintaining a Department of Industries for very similar purposes, but as the tendency in Government matters is toward decentralization, the influence of this central department is through the provincial departments, although, from the nature of the circumstances, this central bureau can exercise the stronger influence in certain directions. But in certain instances the assistance of the Government will be far stronger. Through the placing of contracts it is possible to support an enterprise, and in some cases the Government has guaranteed to place certain orders over a period of years. In other instances it will be possible to make a cash grant or extend a loan from the provincial treasury. Obviously these powers have been restricted in certain ways, but the procedure is possible and for certain enterprises probably will be followed.

Following out the plans indicated above, certain specific problems have been referred to committees which have made very comprehensive studies. For example, a sugar committee has devoted more than two years and visited every Province in India in an effort to improve the condition of the sugar industry. A railway committee has examined the shortcomings of the railways. A hydroelectric survey has been studying water-power possibilities since 1919. In these and other directions the Government has extended very definite aid to industry.

NEW PROBLEMS CREATED BY EXISTING SITUATION.

The increased industrialization of India and the increased participation of American manufacturers in the industrial-machinery trade there create a new series of problems for the American foreign-sales manager to face. Some of these problems are obvious, but there are also complications. Previously the railways, the mines, the plantations, in fact all of the large corporations maintained offices in London and made their purchases there. The 1913 rules for the purchase of stores in India stipulated that "Articles which are not manufactured in India should be obtained by indent upon the State Department of the India Office."[5] For these reasons the market for industrial machinery in India was, to a large degree, located in London.

Coincident with the demand for the establishment of industries in India, there has also been a demand that the Government, public utilities, and large enterprises encourage these enterprises by patronizing them. The "swadeshi" movement has been a popular effort to encourage Indians to patronize home industry. These ideas recur from time to time, and the feeling among the Indians becomes very intense. In 1921 the mob in Bombay burned imported cotton goods in order that greater patronage might go to the mills of India. Recent reports indicate that changes have been made in the arrangements for purchasing Government stores and suitable offices will be opened in India, authority being given to purchase materials of Indian manufacture when practicable and to purchase imported

[5] Indian Trade Journal, July 31, 1913, p. 214.

stores from merchants in India under certain restrictions. Some reports even suggest that these stores may be purchased "in the cheapest market." Full information has not yet been received, but it can be definitely stated that there is a strong tendency toward increasing the amount of purchasing done in India and decreasing correspondingly the influence London exerts in this connection. This will have a strong influence on even private purchases in India, making it necessary to exert greater sales effort in that country than has been the case heretofore.

Machinery dealers have been established in India for a long time. Some of these companies are quite large and enjoy very good reputations. In some instances large stocks of machinery are carried. In all probability the changes indicated above will increase the business and influence of these merchants, and it is to be expected that new companies will enter the field. The old companies have long acted as agents for a good many British manufacturers.

But in view of the conditions mentioned above, it is obvious that the past is an unsatisfactory index of what may be expected in the future. The more one studies conditions in India the more the conviction is strengthened that the demand for machinery will increase rapidly and that America's share will also expand.

PHYSICAL FEATURES—POPULATION—SOCIAL CONDITIONS.

It is not possible to describe India and the conditions existing there without conveying impressions that are inaccurate. The country is very large, with almost every conceivable climatic and topographical condition. In the deserts of the northwest there is practically no rainfall. Karachi is said to have about 5 inches per year, all of which falls in about two hours on the breaking of the monsoon. At the other extreme is Cherrapunji in northeastern India, one of the wettest places in the world, with an average rainfall of 458 inches (more than 10 times the average in New York of 43.27 inches), where an unusually wet season may mean possibly 10 or 15 feet more rain than the normal. The northern boundary of India is in the Himalaya Mountains, which include an area some 250 miles long and about 50 miles wide, with many peaks higher than 18,000 feet and with Mount Everest, highest of all mountains, at about 29,000 feet.

The people show as great variety as the climatic and topographical features. From the dawn of history India has been subjected to repeated invasions and perhaps ceaseless wars. Aboriginal types still exist. As a result, there is a very complex mixture of race, type, language, religion; in fact an endless variety of methods of thought, standards of living and morals, and ways of doing business. The methods of living and the methods of travel, even railway travel, have little or nothing in common with those known in the United States.

But, on the whole, India is a most important territory, capable of producing a wonderful assortment of raw materials and manufactured products in very large quantities. The abundant population makes development possible, as contrasted with conditions in, say, Australia or South America. India deserves the careful attention of all interested in world-wide business.

Opposite the first page of this section of this report is a map of India, superimposed upon one of the United States that is drawn to the same scale, and the relative areas and distances are as accurate as is practicable in commercial map work, so that the relative impressions conveyed are accurate. India, with an area of 1,802,657 square miles, is about 60 per cent of the size of the United States (area 3,026,789 square miles) and is one of the largest countries of the world, ranking seventh in size, but ranking either first or second in population (depending upon the accuracy of the estimates made of the population of China, said by some to be less than 300,000,000 and by others to be in excess of 400,000,000). India has a decennial census, and the result in 1911 gave a total population of 315,156,396 (1921 returns are not yet available) as compared with 105,710,620 (1920 figure) in the United States. But mere numbers give no satisfactory measure of the relative importance of these countries. It has been estimated that the industrial development in the United States multiplies the individual productive capacity by 30. India's industrial development is still limited; it lacks these mechanical aids, so that it is quite probable that its total productive capacity is less than 20 per cent of that of the United States, establishing a standard of living perhaps one-fifteenth of that known here. It is very difficult indeed for an American to imagine such conditions. They have to be seen and felt before their significance can be realized.

Of the people of India only 59 per thousand are literate in any language, and there are 220 separate spoken languages of 5 different ethnological groups. There are also a large number of mixtures or "patois." It is said that "the language changes every 10 miles." There is a corresponding confusion of religions; one meets Mohammedans who include Hindu concepts in their faiths, and Hindus with Mohammedan ideas, all complicated with a multitude of sects and the evils of the caste system. In such a country where travel is difficult, communications inadequate, and education lacking, progress is necessarily very slow. The caste system alone is one of the most powerful systems devised for resisting change and yet, in spite of all this and more, India is developing very rapidly and must adopt the industrial systems of the Occident. Apparently it will adopt these systems not only willingly but anxiously and to the great advantage of the people.

Although the average density of population is high—175 per square mile—the variation is greater than in the United States. In the northwest where rain is insufficient Jaisalmer State has a density of only 5 inhabitants per square mile. Baluchistan has even less. At the other extreme there are one or two small areas in the fertile Ganges Valley where, in agricultural districts, the population is 1,800 to 1,900 per square mile. Generally speaking, the population is most dense in the Ganges Valley, the south of India, and narrow fringes on the coast where the density is between 175 and 600 per square mile over large districts.

Labor receives a very small wage. The average day's pay in the Bengal coal field in 1916 was 7½ annas (say, 15 cents). Labor on the Bombay docks receives from 9 to 16 annas (18 to 32 cents). Labor in Calcutta jute mills receives 13 rupees per month (say, $4.53). Other classifications are paid to correspond, so it is not uncommon to find men whose wardrobe represents an investment of

less than 25 cents. Similarly, many are underfed. The Government finds it necessary to relieve famine from time to time. Obviously, these free rations for the vast number involved are reduced to a minimum, and yet it will be found that a whole group will have gained an average of 14 pounds in weight during the relief period.

Disease also handicaps development. Careful tests have revealed that in certain groups of laborers from 60 to 80 per cent or even more are infected with hookworm. Malaria is comparatively common and rather severe. Dengue fever also disables many. Cholera, smallpox, dysentery, plague, and influenza kill millions. Adequate medical and sanitary help is not available. The loss in effectiveness and the suffering resulting from these conditions are staggering.

Industrial processes are primitive. Land is still cultivated with the wooden type of plow that has been used for centuries. Water is lifted from wells for irrigation, and vegetable oils are extracted by rather crude bullock-driven appliances. Similar examples could be added indefinitely, but the redeeming feature is that a new spirit is at work and, whatever may be the cause, the extreme conservatism of both Indian and European seems to have been broken. All classes—Indians, Europeans, Government officials, private citizens, men of influence in India and in London—invite development. India is progressing. The task is large, difficult, and complicated, but is being faced intelligently.

BRITISH INDIA AND THE NATIVE STATES.

British dominion in India started at Calcutta and spread over Bengal and farther. It has been a gradual growth, and there have always been a number of native States having greater or less independence. At the time of the great mutiny, in 1856, several of the princes assisted the British, and for their loyalty the British Government has guaranteed that these princes and their lines shall rule these States in perpetuity. In most cases these princes are theoretically absolute despots so far as the internal affairs of each State are concerned, but the British control all foreign affairs. In practice the British also restrain excesses in domestic matters. British India is the name applied to those parts of the Indian Empire where the British exercise authority in the local governments. This represents about 60 per cent of the area—1,093,074 square miles—and 78 per cent (244,267,542) of the population. The combined area of the native States is 709,583 square miles, and the population is 70,888,854, divided among 631 States of the greatest variety as to size, strength, and wealth, with the political standing of their chiefs varying from that of practical independence in local affairs to that of complete dependence. Some of the States are almost unbelievably small, as, for instance, Darkut, having an area of about 5 square miles, and a population of 595; or Bija, with an area of 4 square miles, and a population of 1,171. Others are very important, as, for instance, Hyderabad, with an area of 82,698 square miles, and a population of 13,374,676 (Kansas has an area of 82,158 square miles, and a population of 1,769,257). Yet, even in this century, the Nizam of Hyderabad is the absolute overlord of this great State, possessing untold wealth and all that one would expect of a Mohammedan oriental potentate.

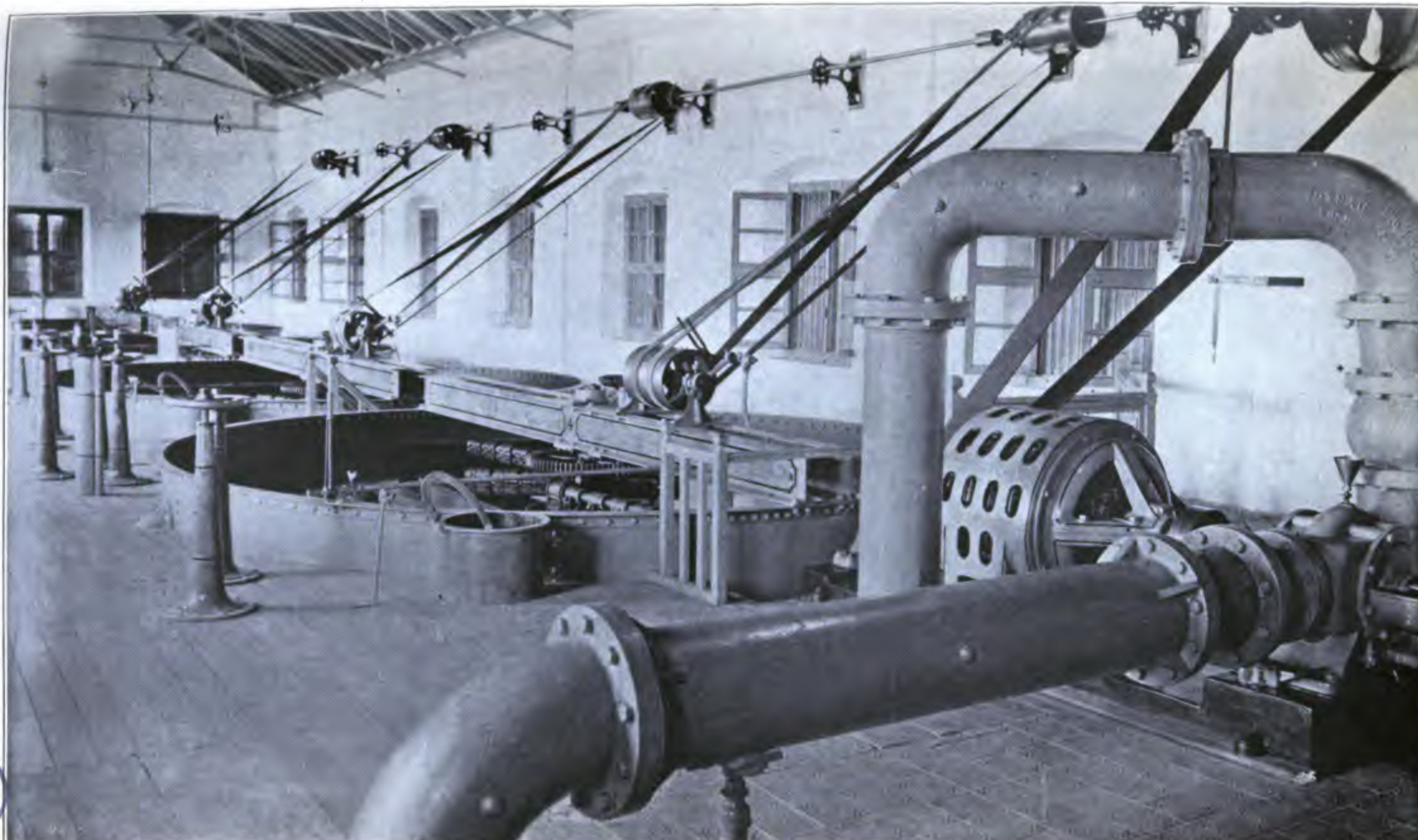

FIG. 20.—INTERIOR OF FILTER HOUSE, CAUVERY POWER SCHEME, MYSORE, INDIA.

FIG. 21.—AMERICAN ELECTRICAL MACHINERY USED IN CONNECTION WITH CAUVERY POWER SCHEME.

The most important of the Native States are shown in the following table:

Indian Native States.	Area, in square miles.	Population.	American States comparable in extent of territory.		
			States.	Area, in square miles.	Population.
Hyderabad	82,698	13,374,676	Kansas	82,158	1,769,257
Kashmir	84,432	3,158,126	....do		
Jodhpur	34,963	1,075,269	Maine	33,040	768,014
Mysore	29,475	5,806,193	South Carolina	30,989	1,683,724
Gwalior	25,133	3,102,279	West Virginia	24,170	1,463,701
Bikanir	23,315	700,983	....do		
Jaipur	15,579	1,385,750	Maryland	12,327	1,449,661
Rewah	13,000	1,514,843	....do		
Baroda	8,182	2,032,798	Massachusetts	8,266	3,852,356

Hyderabad is the largest of the native States; and although it is compared to Kansas above, it can scarcely be compared other than as to area and population. The Nizam's State Railway (operated by a private company, but with returns on the investment guaranteed by the State) has a length of 330 miles. The railways in Kansas are 9,386 miles in length (even in 1870 there were 1,501 miles). In other ways Hyderabad conveys the impression that it is not yet well developed. On the other hand, it has its own post office, mint, and a generating station with a capacity of 3,000 kilowatts, and it is reported that this plant will soon be extended to have a capacity of 9,000 kilowatts.

Mysore enjoys the reputation of being the best-developed Native State. It has a water-power plant at the falls of the Cauvery River that has been developed to a capacity of 22,650 horsepower, and it was reported that it would be extended to a capacity of 32,000 horsepower. Mysore also has, as a State monopoly, the production of sandalwood oil. The authorities are developing a plant to produce charcoal iron and have many other plans. Operations like the above command respect, and in the Native States, as in other parts of India, there is a great desire to industrialize the country. Undoubtedly other enterprises will be developed when the opportunity is seen and the necessary funds are available, and the matter of money will not ordinarily be found too difficult, as the princes ruling these larger States are reported to be very wealthy. One of them is said to have a hoard of 500 tons of silver.

Baroda enjoys the reputation of being the most enlightened State, and the Gaekwar has tried hard to improve the condition of his people, even going so far as to pay wages to the children attending school; but the ignorant parents do not appreciate this very much, because the children are often transferred to work in the fields when the agricultural wage is a little higher than the Gaekwar's gratuity. This prince is more enlightened and progressive than his people.

The railway mileage in all of the native States is slightly over 5,000—14 per cent of the Indian total, in 40 per cent of the area, and for 22 per cent of the population.

It should also be remembered that there are a number of small bits of territory in India that are held by France and Portugal, as at

Pondicherry, Goa, Diu, etc. These are not of great commercial or industrial importance.

RAILWAY DEVELOPMENT.

Carrying further the comparison shown by the map at the beginning of this section, it is interesting to note that on March 31, 1919, India had 36,616 miles of railway in operation, an amount approximating the total in the United States in 1865, at the close of the Civil War, or, if we correct to allow for the smaller area of India, the mileage corresponds to that in the United States in 1871. At that time in this country the railway gauge had not been standardized, and similarly India now has several gauges, as follows:

	Miles.
Gauge of 5 feet 6 inches (Indian standard)	17,994
Meter gauge (3 feet 3⅜ inches)	15,078
Gauges of 2 feet 6 inches and 2 feet	3,544
Total	36,616

This total represents rapid progress (allowance being made for the complications introduced by the war), as the total mileage has increased, as indicated by the following figures:

	Miles.		Miles.
1853	20	1913	34,656
1863	2,507	1915 [6]	35,285
1873	5,697	1917 [6]	36,286
1883	10,458	1919 [6]	36,616
1893	18,504	1920 [6]	[7] 36,735
1903	26,956		

Correspondingly there has been an increase in the volume of traffic, as shown herewith:

Year.	Total number of passengers carried.	Total tons of freight carried.	Year.	Total number of passengers carried.	Total tons of freight carried.
1909	329,380,000	60,902,000	1915	476,039,000	88,738,000
1911	410,013,000	78,880,000	1917	436,563,000	89,500,000
1913	457,718,000	82,613,000	1918	471,630,000	98,875,000

In the United States in 1918 the railways carried 1,084,997,896 passengers and 2,305,824,940 short tons of freight.

But the traffic develops more rapidly than the facilities, and the railways do not give satisfactory service for either the passenger or freight traffic—this condition becoming so pronounced that, on October 9, 1920, the Government of India appointed a special committee to consider problems pertaining to railway administration, management, and finance. The report of this committee recommends some very material changes. It is anticipated that these will result in great improvement, but it is also probable that it will not be practicable to develop railways in India so rapidly as to keep up with the growing demands of more than 300,000,000 people who have definitely embarked upon a program of industrialization.

[6] Fiscal year ended March 31.
[7] A further 1,822 miles have been sanctioned for construction.

IRRIGATION.

Probably in no other direction can such progress be shown for India as in irrigation, and those in authority deserve great praise for what they have accomplished. Although a certain amount of work has been done since prehistoric times, the modern phase of irrigation in India dates from the appointment of a special commission in 1901 which substituted a definitely constructive policy for what had previously been more in the nature of spasmodic effort combining grants for famine relief with measures that would assist in combating famine. The commission found that, out of an area of 226,000,000 acres annually under crop in the Provinces of India employing irrigation, some 44,000,000 acres (say, 19½ per cent) were ordinarily irrigated. Of the area irrigated, about 18,000,000 acres (say, 42 per cent) were cared for from State works, and 25,500,000 acres (say, 58 per cent) from private works, of which rather more than half was from wells. By the end of the fiscal year 1918–19 the capital outlay on Government irrigation had expanded to a total of £50,941,270, and 16,270 miles of main canals and branches and 38,810 miles of distributaries irrigated 18,912,213 acres. The revenue received was £3,794,005, or 7.45 per cent on the total capital outlay.

In the United States, up to June 30, 1919, Government irrigation totaled 12,294 miles of canals, and while it is not possible to compare distributaries, the total irrigable acreage was 1,636,159, and the total disbursements (1920) $153,225,912.

As in the United States, the incidental values of the irrigation works of India are very important, as the canals are used for transportation and water power. Irrigation in India is very well developed, but is still progressing well, as is shown by the following:

Years.	Miles of canals.	Miles of distributaries.	Acreage irrigated.	Net revenue.
1909-10	15,404	32,032	16,114,788	£2,464,390
1914-15	15,887	35,706	17,810,518	3,262,003
1918-19	16,270	38,810	18,912,213	3,794,005

It would appear that there is a very large opportunity for the use of machinery in connection with irrigation from wells in India. It is not easy to secure accurate figures on such a subject as this, but the following statement seems to be dependable: In the United Provinces there are about 1,500,000 wells used for irrigating about 6,000,000 acres. As shown above, there are in all India about 13,000,000 acres irrigated in this way, suggesting a total of more than 3,000,000 wells. Obviously there are a great many types of well in use, but it will probably be sufficiently accurate for the purpose of this report to describe these as pits, possibly 40 feet in diameter, having a capacity of, say, 40,000 to 50,000 gallons per day, all of which may be removed in perhaps four hours out of the 24. The distance from the ground to the water varies widely, of course, but it is probably safe to say that it seldom exceeds 40 feet. The depth below the water is also variable, but might be taken as 6 feet. All

these conditions vary as the water is pumped down during the day, and also changes as the season advances.

Probably the commonest method of raising the water is by the so-called "Mhote," which consists of a pigskin or other receptacle for water that is raised to the surface by one or two bullocks or a corresponding form of power. But there seems to be reason to believe that this system is being supplanted by mechanical power. although the change has scarcely started. There are in the south of India alone at least 1,000 pumping stations using small mechanically driven pumps, most of which are equivalent to, say, a 3-inch centrifugal pump driven by a small kerosene engine. It has been demonstrated that the mechanical method is cheaper than that using bullock power. It has been stated that the agricultural engineer of the United Provinces had at one time a list of more than 600 landholders who had applied for pumping installations as soon as they could be supplied. It is clear that India will probably absorb a very large number of these small pumping units during the next few years. In this connection it should be remembered that the authorities are also encouraging the use of a larger number of wells, and it is probable that ultimately the acreage served by wells will be double that now so served. In certain districts the government is assisting by boring "tube wells."

The use of mechanical pumps for this purpose is largely the result of the pioneer work of Sir Alfred Chatterton, who has in the past arranged for special designs to be developed for this purpose. Sir Alfred was so kind as to inform the writer that it seemed that the volume of this business was so large as to justify the development of a special type of pump for the purpose and that a unit operating on the principle of Humphrey's gas-pumping engine would probably be very attractive if successfully developed in these small sizes. Electric power is not yet available for the above purposes except in certain very restricted districts and is a negligible factor in the problem.

PRODUCTION AND CONSUMPTION OF COAL.

The production and consumption of coal in India provide an interesting indication of the industrial development of the country, and a special survey made during the war provides very interesting data; the annual consumption of coal per capita in 1911 is stated as follows:

	Tons.		Tons.
India	0.04	New Zealand	2.00
Russian Empire	.19	German Empire	2.00
Japan	.25	Canada	3.03
Austria-Hungary	.52	Belgium	3.21
South Africa	.92	United Kingdom	4.08
France	1.44	United States	4.54
Australia	1.65		

In the warm climate of India only very small quantities of coal are required for ordinary heating. Consumption in residences is practically nothing. The railway mileage per capita is very low. The steel industry per capita is very small indeed. Yet there has

been a very definite development, as indicated in the following returns, which are compared with those of Japan:[8]

Year.	Production of coal.		Imports of coal.		Exports of coal.		Consumption of coal.	
	India.	Japan.	India.[1]	Japan.	India.[1]	Japan.	India.	Japan.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1906	9,783,250	13,043,874	226,365	34,525	1,003,192	2,402,354	9,006,423	10,676,045
1907	11,147,339	13,496,044	301,588	18,164	658,194	2,875,521	10,790,733	10,638,687
1908	12,769,635	14,587,098	385,323	30,148	660,633	2,817,102	12,494,325	11,800,144
1909	11,870,064	14,732,970	490,421	129,858	563,940	2,798,563	11,796,545	12,064,265
1910	12,047,413	15,429,303	315,996	171,805	988,375	2,770,788	11,375,034	12,830,320
1911	12,715,534	17,251,456	318,669	256,565	862,384	3,250,816	12,171,819	14,257,205
1912	14,706,339	19,324,116	560,791	303,374	898,996	3,412,136	14,368,134	16,215,354
1913	16,208,009	20,973,384	644,934	567,502	759,210	3,808,394	16,093,733	17,732,492
1914	16,464,263	21,825,753	418,758	942,318	579,763	3,529,161	16,303,258	19,238,910
1915	17,103,932	20,161,431	190,654	599,999	753,105	2,854,264	16,541,481	17,907,166
1916	17,254,309	22,533,519	34,033	547,173	882,454	2,968,460	16,405,888	20,112,232
1917	18,212,918	25,937,754	44,818	701,620	409,215	2,768,246	17,848,521	23,871,128
1918	20,722,493	....	....	....	....	....	....	....
1919	22,628,037	....	....	....	....	....	....	....

[1] Excludes Government stores.

A census of coal consumption was taken in India as for the year 1917, when the total coal production was 18,213,000 tons, imports 45,000 tons, and exports 409,000 tons, with the consumption divided as follows:

Industry.	Consumption.	Per cent of total production.	Industry.	Consumption.	Per cent of total production.
	Tons.			*Tons.*	
Railways and railway shops	5,620,000	30.9	Arms and ammunition plants	178,000	1.0
Bunker coal for shipping	1,514,000	8.3	Paper mills	170,000	.9
Admiralty and Royal Indian Marine	1,429,000	7.8	Oil mills	160,000	.9
Jute mills	1,026,000	5.6	Waterworks	124,000	.7
Cotton mills	927,000	5.1	Electric power plants	96,000	.5
Foundries and workshops	807,000	4.4	Tramway works	85,000	.5
Steamships on inland waterways	508,000	2.8	Gold mines	84,000	.5
Brick, tile, pottery, and cement plants	358,000	2.0	Sugar factories	77,000	.4
Cotton gins and pressers for cotton and jute	294,000	1.6	Gas works	63,000	.3
Tea gardens	248,000	1.4	Lime works	61,000	.3
Flour and rice mills	225,000	1.2	Breweries and distilleries	54,000	.3
Harbors and dockyards	201,000	1.1	Petroleum refineries	51,000	.3
			Others	507,000	2.8
			Total	14,867,000	81.6

Adding to the above total the net exports of 363,000 tons leaves a little more than 2,600,000 tons as representing the wastage and consumption at the mines, the consumption in dwellings, and the unenumerated items.

Reviewing the three tables published above, it is at once apparent that the per capita consumption of coal is probably much lower in India than in any other important country in the world. In 1906 Japan had scarcely finished the war with Russia and Japanese in-

[8] The figures in this table and much of the other data presented herein are from the publications of the Government of India, to which, in some instances, data from other sources have been added.

dustrial development was a very new phenomenon, yet even at that time the total coal consumption in Japan exceeded that of India, entirely apart from discrepancies in size, resources, and population. Even for 1917 India consumed only the amount of coal used by Japan in 1913, and in that year the smaller country used 34 per cent more coal than the larger.

Since 1917 there have been very important changes. Demand has increased very rapidly, and in spite of increased imports it has been necessary to place an embargo on exports, and the coal supply is not sufficient to meet the demands of the country.

To a very large degree the fuel problem is a labor problem. With the increasing demand, wages have been advanced, and the production has declined as these advances have been made. The supply of labor is drawn from the agricultural classes and is always more or less inadequate, conditions being poorest when the rains make agricultural conditions best. The following quotation from the 1921 report of Thomas M. Aincough, O. B. E., senior British trade commissioner for India, describes the situation:

> The problem of coal supply is becoming most serious. At the present time, the raisings, which in 1920 amounted to 22,628,000 tons, are not sufficient for the requirements of the country, even since the embargo was placed on exports of coal. Many factors contribute to this unfortunate position. The supply of labor in the fields is always more or less inadequate, and now that increased rates of pay are being given, it is understood that the output has declined, as the miners work fewer days per week. Transport has been a further difficulty, the number of wagons being frequently short; and, also, in some places the siding accommodation is inadequate. Until recently mechanical coal cutters have proved unsuccessful; but the machines recently introduced are, it is understood, better suited to Indian conditions. The leading companies are now making serious attempts to introduce coal cutters and mechanical labor-saving devices of all kinds in order to overcome their labor difficulties.[9]

As all concerned are committed definitely to the policy of promoting the industrial development of India and as this development is dependent upon increased coal production and improved railway facilities, it seems clear that important improvements will be made in the near future.

The above returns from the 1917 coal census provide an indication of the size and relative importance of the various industries of India, but it should be remembered that there are also a number of important water-power developments and that the cotton industries in particular are so driven, and it is not wise to place too much emphasis on this one table.

The following table, showing coal tonnage produced per annum per employee (above and below ground), provides an interesting comparison of the cost and efficiency of labor in various countries.

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[9] This is one of the many items that confirm the statements made in the general section of this report as to the desirability of employing labor-saving devices in Asia. In spite of its low wage, oriental labor is not cheap, and is extraordinarily difficult to handle. It is also usually desperately ignorant and inefficient. The average number of laborers employed in the Bengal coal field in 1916 was 135,093, the average daily wage per capita was 7.6 annas (15 to 25 cents, depending upon the exchange rate selected) and for all India the amount of coal raised per head of labor employed below ground was 169.4 tons, as compared with 323 tons in the United Kingdom and 800 (long) tons in the bituminous fields of the United States. Obviously coal mine managers in India have urgent need for "labor-saving devices of all kinds" and American engineers have developed these devices to a point not equaled elsewhere.

Regions.	1906 to 1910 average.	1911	1912	1913	1914	1915	1916
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cape of Good Hope	59	71	72	70	58	64	(1)
India	100	109	111	112	109	107	110
Japan	109	119	127	122	117	112	114
Russian Empire	151	(1)	(1)	(1)	(1)	(1)	(1)
Belgium	163	157	155	[2] 153	(1)	(1)	(1)
Austria	188	191	207	[2] 214	(1)	(1)	(1)
France	192	193	200	[2] 201	(1)	(1)	(1)
Natal	228	243	262	250	227	222	(1)
German Empire	247	248	268	288	(1)	(1)	(1)
United Kingdom	275	260	244	259	238	266	257
Orange Free State	301	274	292	298	323	328	(1)
Transvaal	333	439	459	463	446	449	(1)
Canada	439	395	472	506	445	480	(1)
Australia	462	485	542	531	512	516	(1)
New Zealand	470	481	503	444	481	531	(1)
United States	596	613	660	681	601	711	(1)

[1] Returns not available. [2] Provisional figures.

Generally speaking, since 1912 the average number of employees in the Indian coal fields has been between 130,000 and 170,000. It does not seem at all probable that the number can be increased to correspond with the increasing demand for coal, and the conclusion in favor of labor-saving devices seems definite. As the apparent coal reserves of India represent as much as would be needed in nearly 400 years at the present rate of consumption, it seems that the coal can be secured if the properties are developed adequately.[10]

COAL COSTS.

Coal also interests the manufacturer of machinery in so far as it measures the importance of fuel economy, and this is a problem that would have a different answer for every different city in India. It is also difficult to offer a satisfactory statement as to quality. All Indian coal is bituminous, and most of it seems to be friable and of only medium quality. The coal commonly sold is probably Desherghur (named from one of the seams in the Raniganj field), the prices of which were as follows in rupees, annas, and pie:

Year.	F. o. b. cars at mine.	Calcutta.	Bombay.	Karachi.[a]
	R. A.	*R. A. P.*	*R. A. P.*	*R. A. P.*
1906	2 10	4 10 0	13 0 0	13 1 0
1907	3 5	6 4 0	15 11 0	17 7 0
1908	3 12	6 12 0	15 10 0	19 14 8
1909	3 4	4 4 0	13 7 0	16 13 4
1910	2 13	4 9 7	13 3 0	14 0 8
1911	2 11	3 12 0	13 7 8	13 0 8
1912	3 11	6 3 7	17 6 4	17 11 4
1913	3 12	6 8 0	18 5 8	18 9 4
1914	3 13	7 5 0	16 5 8	18 8 0
1915	3 6	5 5 8	17 3 6	19 12 10
1916	3 9	5 1 4	25 0 0	20 3 4
1917	3 15	6 0 0	27 0 0	24 13 0

[a] Trimmed into bunkers.

[10] In other sections of this report the fuel problems of other oriental countries are mentioned. On the average, during the years 1911 to 1915, India exported coal as follows: Ceylon, 479,000 tons; Straits Settlements, 157,000 tons; Sumatra, 96,000 tons; Aden, 11,000 tons; Java, 4,000 tons; Mauritius, 2,000 tons; others, 22,000 tons; total, 771,000 tons. The present embargoes on exports will correspondingly embarrass the above countries, although it is probable that certain British interests will be provided for.

An estimate of the quality of this Desherghur coal can be made from the comparison with the price of Cardiff coal at Bombay, which was as follows:

Year.[1]	Desherghur.	Cardiff.	Year.[1]	Desherghur.	Cardiff.
	R. A. P.	*R. A. P.*		*R. A. P.*	*R. A. P.*
1906	12 0 0	16 2 0	1912	13 7 8	20 1 8
1907	13 0 0	18 12 0	1913	17 6 4	23 2 2
1908	15 11 0	21 11 0	1914	18 5 8	24 5 0
1909	15 10 0	21 0 4	1915	16 5 8	23 14 0
1910	13 7 0	17 10 0	1916	17 3 6	39 2 8
1911	13 3 0	18 14 0			

[1] 12 pie=1 anna; 16 annas=1 rupee. During the above period the rupee was ordinarily worth between 31 and 33 cents.

First-class Bengal coal rarely contains less than 12 per cent of ash, is rather high in volatile matter, and forms a strong coke.

GEOGRAPHICAL VARIATION IN FUEL PRICES.

Besides affording a measure of industrial development, coal data also provide information indicating the extent to which one is justified in investing capital in devices to secure fuel economy, it being remembered that American machinery employed in these ways represents a capital investment some 50 per cent or more above the price in the United States. Figures given above show that steam economy and furnace efficiency are far more important in Bombay than in Calcutta. The table below shows the influence of freight and similar charges on the price of Bengal coal delivered in various parts of the country. These data are based on a price at the Bengal mine of 5 rupees per ton. In some instances coal from districts other than Bengal is available, in which cases an effort has been made to show the price of the other grades as well. These figures represent conditions as they existed in 1917, but are reasonably representative of the general situation:

Cities.	Kinds of coal.	Price.	Cities.	Kinds of coal.	Price.
		R. A.			*R. A.*
Asansol	Bengal	5 0	Wadhwan	Bengal	16 12
Calcutta	do	.. ..	Nagpur	do	12 0
Sasaram	do	9 0		Bellarpur	7 8
Cawnpore	do	11 8	Bombay	Bengal, by sea	16 0
Saharanpur	do	13 8		Bengal, by rail	17 8
Amritsar	do	15 0	Barsi	Bengal	18 12
	Punjab	11 0		Singareni	10 0
Peshawar	Bengal	17 0	Dornakal	Bengal	17 0
	Punjab	10 8		Singareni	6 0
Multan	Bengal	16 8	Vizianagram	Bengal, by sea	13 0
	Punjab	12 0		Bengal, by rail	12 0
Quetta	Bengal	19 0		Singareni	12 0
	Local	9 0	Goa	Bengal, by sea	15 0
Sukkur	Bengal	17 8		Bengal, by rail	24 0
	Baluchistan	12 0		Singareni	12 0
Karachi	Bengal, by sea	16 0	Madras	Bengal, by sea	13 0
	Bengal, by rail	18 0		Bengal, by rail	16 0
Kotah	Bengal	14 0		Singareni	12 0
Katni	do	11 8	Rangoon	Bengal, by sea	16 0
	Umaria	6 0	Chittagong	Bengal, by rail	15 0
Bilaspur	Bengal	10 8	Mymensingh	Local	6 0
	Umaria	8 8	Sadiya	Assam	9 0

STEEL AND IRON INDUSTRY.

India has only lately developed into a steel-producing country, although iron has been produced since 1875, but this development

promises to be of very great importance and the success already attained seems to indicate that it will have a very pronounced effect upon the imports needed in the industrial development of the country.

The first important plant was installed at a point on the Bengal-Nagpur Railway, 155 miles west of Calcutta. The railway station near by was called Kalimati and the actual site of the plant Sakchi. More recently the name has been changed to Jamshedpur in honor of one of the founders. The company was formed in 1907, and production started in 1912. Largely because of the ability of American experts, this plant was demonstrated to be a pronounced success about 1914, and its production has been:

Years.	Pig iron.	Finished steel.
	Tons.	*Tons.*
1916	152,460	36,595
1917	167,868	72,670
1918	198,064	71,069
1919	(1)	(1)
1920	88,990	120,570

[1] Figures not at hand.

The significance of this development is outstanding, and in view of its newness and changing conditions in a developing country it has been difficult to plan the plants in a consecutive way. The plant includes 180 Coppée nonrecovery coke ovens, 50 Koppers by-product coke ovens, and 200 Wilputte-type coke ovens, which with a Simon Carve sulphuric-acid plant, produce coke, coal tar, sulphate of ammonia, gas, and benzol. There are six blast furnaces complete. Slag is used for making granulated slag bricks. The steel plant consists of a number of open-hearth furnaces and steel mixers, and, according to the plans, the larger of the mixers is to have a capacity of 1,200 tons. There are also to be two 25-ton Bessemer converters, a 200-ton tilting furnace, a 6-ton Heroult electric furnace, a 40-inch blooming mill with 11,000-horsepower engine, a 28-inch finishing mill, with 12,000-horsepower engine, a second and larger rail mill, one 16-inch and two 10-inch bar mills, an electrically driven plate mill for widths up to 84 inches, a sheet equipment, including bar and billet mill and sheet mill to produce sheets up to 38 inches wide, a wire mill to handle 20 tons per day, a bolt and nut shop to produce 50 tons per week, all with laboratories, shops, offices, and yards complete. To a large degree the above plant seems fully equipped, but, on the other hand, a plant of this sort is never complete and many of the above details may have been altered, as conditions in India have been changing very rapidly. As matters stood in 1921 it was planned to develop a plant that would be able to sell 174,000 tons of pig iron and 425,000 tons of finished steel per year. This will be done provided the railways can be persuaded to furnish the transportation facilities needed to support such a plant.

At any rate, by 1917 the above company employed about 13,000 men, at which time contractors employed 10,000 more in building extensions. Owing to the success of the Tata Iron & Steel Co. others are embarking in the business. An older company, the Bengal Iron & Steel Co., has been producing pig iron since about 1875. The

poor quality of the ore used by this company is said to be responsible for the failure of their early efforts to make steel. Their plant in 1917 had four blast furnaces, each with a capacity of 80 tons of pig a day, or, say, 10,000 tons a month, but during the war a demand for ferromanganese developed and one furnace employed in this way had a capacity of 1,200 to 1,500 tons a month, the product being exported for war purposes. This company employs about 10,000 men. The name has recently been changed to the Bengal Iron Co. (Ltd.).

The Indian Iron & Steel Co. (Ltd.) is building some blast furnaces at Asansol. Some other companies are being promoted by important interests in the steel industry of the United Kingdom, as, for instance, the one in which Cammel Laird & Co. will participate. This is reported to be a very large and substantial plant, capitalized at more than $75,000,000. Bird & Co., the well-known Calcutta firm, will be associated in this venture.

In view of this development of the steel industry, there has been a distinct tendency toward the establishment of subsidiary plants near Jamshedpur, to make additional articles from the steel produced there. During the industrial boom of 1919–20 some 17 of these subsidiaries were well on toward promotion and were to produce machinery used in the jute industry, zinc, chemicals, railway wagons, locomotives, agricultural implements, wire products, tin plate, enameled ironware, cables, and reinforcement steel. Not much progress has been made with these during the last few depressed months, but there is reason to believe that these projects have only been postponed, not abandoned.

From the above it will be recognized that there is a good industrial future for India. Pig iron has been exported from the Tata plant to Burma, the Straits Settlements, Ceylon, Java, China, Japan, Australia, New Zealand, the United States, the River Plate, etc., affording evidence that India can produce iron and steel at a favorable price. But the undeveloped state of the iron and steel industry, the shortcomings of the railways, the problem of increased coal production, and certain other factors create an involved industrial problem that will require much work and possibly some time to overcome. On the other hand, the progress of the country is far more rapid than is ordinarily realized. It is not easy to demonstrate this concisely by statistics, but it should be noted that every index shows betterment in the trade of the country and the living conditions of its people. Increased railway facilities and acreage under irrigation steadily diminish the consequences of poor crops in a bad season. Famines are no longer as serious as they were. The poorer classes are living better than they did. More food, better clothing, and better health conditions are now available and the standards of living are rising. It is true that they are rising slowly, but they are rising to the great advantage of the entire world. Although the problems involved are tremendous, the authorities are making real efforts to combat disease, to improve sanitation, to provide education, to eliminate the harmful social customs, and to strengthen the forces making toward bettered conditions. All of this involves an ever-increasing demand for industrial machinery in a great variety of directions; a few of these can be considered in

further detail, but it should be realized that they are only illustrative of what is happening in many other directions.

COTTON SPINNING AND WEAVING.

POSITION OF INDIAN INDUSTRY.

The most important industry in India is that of spinning and weaving cotton, and India ranks fifth among the countries of the whole world as a producer of cotton yarn, being exceeded in number of spindles only by Great Britain, the United States, France, and Germany (Austria and Russia being very uncertain in view of present conditions). The situation is indicated by the following data issued by the International Federation of Master Cotton Spinners' and Manufacturers' Associations under date of July 31, 1920, and indicating a total world spindlage of 145,701,462, exclusive of Austria and Russia, which were thought to have some 8,500,000 spindles altogether:

	Spindles.
Great Britain	58, 692, 410
France	9, 400, 000
Germany	9, 400, 000
Italy	4, 514, 800
Czechoslovakia	3, 584, 420
Elsewhere in Europe	8, 488, 062
Total in Europe	94, 079, 692

	Spindles.
United States	35, 872, 000
Canada	1, 200, 000
Mexico	720, 000
Brazil	1, 600, 000
Total in America	39, 392, 000
India	6, 689, 680
Japan	3, 690, 090
China	1, 600, 000
Total in Asia	11, 979, 770

Although the above returns are open to a certain amount of criticism, especially as regards Germany, it will be noted that of all the countries of the world that do not manufacture their own textile machinery, India is by far the most important market, having more spindles than Japan and China combined.

Also, it should be noted that the industry is not only large but old and substantial. The following figures from the report of the Bombay Mill Owners' Association show the growth of the industry, which was started by a Parsee in 1851:

Years.	Number of mills.	Number of spindles.	Number of looms.	Years.	Number of mills.	Number of spindles.	Number of looms.
1876	47	1, 100, 112	9, 139	1913	272	6, 596, 862	94, 136
1886	95	2, 261, 561	17, 445	1914	271	6, 778, 895	104, 179
1896	155	3, 932, 946	37, 270	1915	272	6, 848, 744	108, 009
1906	217	5, 279, 595	52, 668	1916	266	6, 839, 877	110, 268
1911	263	6, 357, 460	85, 352	1917	263	6, 738, 697	114, 621
1912	268	6, 463, 929	88, 951	1918	262	6, 653, 871	116, 484

Of the above 262 mills, 258 were in operation and 4 in course of erection. Since 1918 the importations of textile machinery into India have been very heavy.

For decades British manufacturers of textile machinery have held a most important position in the markets for this kind of machinery throughout the world, and the importance of India as a market for textile machinery can probably be shown best by the following data, indicating by figures of exports from the United Kingdom

where British manufacturers have secured their business and the comparative importance of the various markets:

Countries of destination.	1907	1913	1919	1920	First 11 months of 1921.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
India	47,554	50,287	21,434	17,946	54,591
France	13,962	12,630	13,895	17,017	21,907
Japan	11,588	19,688	11,547	8,051	20,695
China	2,404	3,321	2,275	2,616	14,514
Netherlands	4,184	12,171	1,285	1,374	2,215
Brazil	8,305	11,863	2,173	(1)	(1)
Belgium	13,339	10,314	1,707	(1)	(1)
Germany	21,960	13,917	....	43	319
Russia	5,190	15,308	275	188	2

[1] Too small to be listed separately.

It is clear, therefore, that the cotton textile industry of India is of very great importance to the country and establishes India as an industrial nation. It is also believed to indicate the possibilities of other industries in India, and now that a definite policy of industrializing the country has been established, the record of the cotton-spinning industry lends important support to the claims of the newer industries. Also the importance of India as a market for textile machinery suggests the present and future importance of this same market for other classes of machinery. Up to 1914 British manufacturers supplied over 90 per cent of the machinery absorbed by India, and obviously this business formed the basis of their trade in many instances.[11]

GREATLY INCREASED SPINDLAGE POSSIBLE.

In preceding paragraphs an effort has been made to show the past and present importance of the cotton textile industry in India, but it should not be inferred that the market for textile machinery is saturated, as there is reason to believe that India could employ a vastly greater spindlage than it now has. In considering this subject it is necessary to take into account Indian export possibilities and also the domestic demand, and for this purpose it seems best to refer to the experience of a pre-war year. For the season 1912–13 the consumption of raw cotton per capita was: India, 4.5 pounds; China, 6.7 pounds; Japan, 12.5 pounds. Corresponding data for occidental countries are: United States, 28.1 pounds; Germany, 12.5 pounds; France, 10.5 pounds; Great Britain, 9.4 pounds; Italy, 8.7 pounds.

In every case the above figures have been corrected to include imports and exclude exports. The returns for China are least de-

[11] The importance of this trade is so great that this one item tends to disturb the perspective of the whole view as represented by this report. The 50,287 tons of textile machinery sent to India by the United Kingdom in 1913 was valued at about £1,992,629, or about $9,681,000. In the same year Great Britain shipped to Japan and China about 23,000 tons of textile machinery, which may be assumed to be worth about $4,400,000 additional, so that the British shipments of textile machinery to Asia in 1913 were worth nearly $15,000,000, a fact that distorts estimates of the value of the world's markets for industrial machinery as presented on page 3 of the introductory section of this report. Since 1913 American manufacturers of textile machinery have devoted more attention to export business, shipping out nearly $21,000,000 worth of such equipment in 1920 and nearly $20,000,000 worth in 1921, with the result that the distribution of the business of supplying "industrial machinery" to the various markets has been entirely changed. This fact does not explain the increase in American exports between 1915 and 1919 as shown on page 3. A number of other influences caused this large increase in American machinery exports to Asia, which has since been maintained.

pendable, but are based on Noel Murray & Co.'s estimate of the Chinese crop at 5,300,000 bales for 1912, to which have been added the net imports of cotton and cotton goods. There is also great uncertainty as to the actual population of China.

Another fact that encourages the belief that India can employ a greatly increased spindlage is the relation with Japan. In spite of the fact that it is something like a three or four weeks' voyage from Bombay to Kobe, India exports a great deal of raw cotton to Japan and imports an important amount of manufactured cotton from Japan. The figures are as follows:

Years.	Exports of Indian raw cotton to Japan (weight, in hundredweight).	Imports of cotton textiles from Japan.		
		Yarn.	Piece goods.	Hosiery.
		Pounds.	*Yards.*	
1914-15	4,454,931	921,730	16,042,064	£443,618
1915-16	5,917,663	701,929	39,101,998	376,041
1916-17	6,153,531	4,007,635	100,122,516	849,682
1917-18	5,187,705	4,206,491	94,655,510	610,631
1918-19	2,797,491	27,280,386	238,261,157	490,617
1919-20	5,918,980	1,917,956	75,953,569	1,223,903
1920-21	3,353,620	20,122,799	170,339,538	1,393,074

No fundamental economic reason seems to exist that justifies such a situation as this. In Japan practically all of the mills depend upon steam power, while in Bombay many mills use power obtained from the 42,000-horsepower hydroelectric plants, which is sold at about 1 cent per kilowatt hour. Bengal coal is as good as Japan coal, and it would seem that Bengal should have a great advantage over Japan in a matter of this kind, yet Bengal has very little spinning-mill equipment. Most of the Indian mills are near Bombay rather than Calcutta. If labor is cheap in Japan, it is certainly cheaper and more abundant in India. If Japan improves the quality of the yarn by an admixture of American fiber, India can do so equally well, and has a certain advantage in connection with long-staple cotton from Egypt, India, and possibly Mesopotamia.

As the cotton mills of India, China, and Japan all pay liberal dividends, it would appear that the above situation merely represents a shortage of mill capacity and that Japan profits by the slowness of the development in India. A report on the profits of the Indian mills for 1920 shows that they earned a profit of 165,300,000 rupees. The spinning mills earned 124 per cent, and the stockholders received dividends of 55 per cent on the original capital. One mill earned 2,105,000 rupees per annum net profits on a capital of 250,000 rupees. Undoubtedly these returns are abnormal, but it also seems certain that the profits have been so large as to allow Japan the opportunity indicated.

In fact, one would expect that if the day ever comes when these oriental markets for textile machinery become saturated, India would be able to drive the mills of Japan out of the export business, even to the extent of supplyng the demand in China, and the volume of this Japanese trade is now very large and is growing rapidly. No limit as to the market for spindles in India is as yet in sight—a

statement that is supported by the rate at which new spinning companies are being established. Following are figures for new cotton mills incorporated in India:

Years.	Number.	Aggregate authorized capital, in rupees.
1913–14	12	8,375,000
1917–18	4	8,200,000
1918–19	6	38,325,000
1919–20	40	234,075,000
1920–21	46	194,550,000

Although it is undoubtedly true that the two years last indicated were years when India was feeling the effects of the most pronounced boom of recent years, it is also plain that there is a distinct demand for textile manufacture there and the point of saturation is not in sight. As India is definitely committed to a policy of protection directed toward the greatest possible stimulation of industry there, it is clear that an effort will be made at least to discontinue the importation of yarn and piece goods made in Japan from Indian cotton if it is at all possible to buy the textile machinery needed for this purpose. In the early months of 1920 British manufacturers of textile machinery were not offering delivery sooner than two years after receipt of order.

Apart from the situation in relation to Japan, as set forth above, there is a much larger opportunity for the Indian manufacturer of textiles in supplanting the supplies imported from other sources. This is indicated by the following figures, representing the total Indian imports of textiles from all sources:

Years.	Twist and yarn.	Piece goods.
	Pounds.	*Yards.*
1914–15	42,864,340	2,445,661,682
1915–16	40,426,924	2,148,100,211
1916–17	29,529,569	1,933,521,578
1917–18	19,400,439	1,555,508,775
1918–19	38,095,413	1,121,974,998
1919–20	15,097,204	1,080,747,882
1920–21	47,333,495	1,509,729,055

These figures are presented to show the demand and should not be misinterpreted. The decrease in volume during years of war and reconstruction is more or less offset by the unit increase in price. The piece goods, for example, always represented a value between £25,000,000 and £33,000,000. Because of the large number of people in India having only a small purchasing power, it is always possible to stimulate purchases by decreasing prices, provided the balance of trade is not so unfavorable as to offset this by fluctuations in exchange.

It is also interesting to note, in connection with the question of the probable future growth of textile-mill capacity in India, that the equipment so far installed has not yet reduced the number of hand-power spinners and weavers to any appreciable degree, if one can draw conclusions from the returns of the Indian census, the experience gained in times of famine, etc.

As compared to the other countries of Asia using textile machinery, India is a large market with a large number of spindles and looms, but is capable of great additional development in the sense that there is a further demand for spindles and also for looms. The following comparison may be of value to those who are more familiar with conditions in Japan or China than with India:

Items.	India.	Japan.	China.
Number of mills	262	198	[1] 70
Number of spindles	6,653,871	3,813,580	1,972,000
Average spindles per mill	25,396	19,261	28,171
Number of looms	116,484	50,583	9,175
Spindles per loom	57	75	215

[1] Estimate.

The spindles-per-loom figure in the United States is about 49 and in Great Britain is about 74. It is remembered, of course, that Great Britain and Japan export yarn, while India and China employ many hand weavers and import large quantities of yarn.

TEXTILE CENTERS OF INDIA.

According to the 1918 report of the Bombay Mill Owners' Association, the mills of India are distributed as shown in the following table, and from this it is plain that machinery manufacturers in soliciting business from the cotton mills of India will need to cultivate the markets in Bombay, which is probably ten times as important as any other point in India, although there is an important number of spindles that can be reached from Madras, Calcutta, or even Karachi:

Location.	Number of mills.	Number of spindles.	Number of looms.	Total number of employees (average).	Cotton consumed.
					Hundredweight.
Bombay Island:					
Working	86	2,882,648	59,162	124,199	3,739,722
In course of erection	1				
Bombay Presidency (other than island):					
Working	[1] 90	1,794,190	34,198	71,727	1,391,460
In course of erection	1				
Total Bombay Presidency	178	4,676,838	93,360	195,926	5,131,182
United Provinces	18	460,356	4,798	15,192	497,994
Bengal Presidency	15	361,801	2,479	11,407	358,204
Madras Presidency	13	420,422	2,696	22,519	459,648
Central Provinces	7	222,312	4,455	14,145	336,413
Pondicherry	8	124,580	965	2,663	72,499
Punjab	6	116,981	3,092	6,558	154,588
Central India [2]	4	70,455	1,634	5,450	76,405
Hyderabad	3	64,730	853	2,547	60,557
Berar	3	46,100	981	2,431	52,563
Rajputana	3	23,192	718	1,083	20,335
Mysore	2	40,544	423	1,634	50,519
Travancore	1	25,560		672	28,966
Chandernagor	1				
Total	[3] 262	6,653,871	116,454	282,227	7,299,873

[1] Of the mills listed in Bombay Presidency but not on Bombay Island the returns of the Government of India for 1917 show 65 mills in Ahmedabad and 7 at Sholapur, with 22 scattered.
[2] One in course of erection.
[3] Four in course of erection.

The Bureau of Foreign and Domestic Commerce has the names and addresses and number of employees of most of these mills. The list is too long to insert here.

The class of spinning equipment required may be estimated in part from the following tabulation of the total yarn spun in India (derived from the report of the Bombay Mill Owners' Association):

Classes.	1916-17	1917-18	1918-19
	Pounds.	*Pounds.*	*Pounds.*
Counts 1 to 10	110,682,164	100,452,492	87,319,699
Counts 11 to 20	369,932,533	346,001,810	314,540,680
Counts 21 to 30	171,487,582	183,667,136	189,204,470
Counts 31 to 40	24,081,681	24,388,708	19,189,215
Above 40	4,577,334	5,842,190	4,555,242
Wastes, etc	345,937	223,279	231,158
Total	681,107,231	660,575,615	615,040,464

CONDITIONS AFFECTING EFFICIENCY OF MILLS.

In general the mills of India, so far as could be seen on a hurried trip devoted to a very wide range of subjects, are of a type familiar to those who know British practice and may be briefly described as having Lancashire boilers, Corliss engines, rope drive, and all that goes with equipment of this class. At the same time it must be added that in such plants as the Buckingham and Carnatic Mills in Madras better engineering was found. One gathers the impression that it would be easy to improve greatly upon the engineering employed in the design of textile mills for India and that this should be one of the fundamentals of any sales policy directed toward this market.

Practically all of the cotton mills of India are owned, managed, and operated by Indians, although some of the more important mills are controlled by Europeans. Labor is cheap, the monthly wages being as follows in 1918 (rates appreciably above those paid in 1914):

	R.	A.
Drawer (card room)	23	6
Reeler	17	4
Warper	40	8
Rover	24	1
Doffer (card room)	12	10
Weaver	46	15

(One rupee=16 annas. Exchange has fluctuated widely. The rupee has been as high as 50 cents and as low as 27 cents since 1920. Probably a fair value is 32 cents or, roughly, 3 rupees per dollar and 2 cents per anna.)

Elsewhere it has been pointed out that Indian labor is inefficient and ignorant, suffers from debilitating diseases like hookworm and malaria, and is deficient in individual strength. These and other considerations indicate that labor-saving machinery should be very useful and there should be a demand in India for mills representing the very best engineering known in America. On the whole, it would seem that India offers a very attractive market for American spinning and weaving machinery and accessories that appertain thereto.

COTTONSEED-OIL INDUSTRY.

Closely associated with the cotton-textile industry is the cottonseed-oil industry, and most Americans visiting India will be disposed to feel that a real business opportunity might be found there, as scientific utilization of the greater part of the Indian supply of cottonseed has never yet been attempted. The United States plants something like 32,000,000 acres to cotton in an ordinary year, harvests something like 10,000,000 bales (more or less), and from this secures about 4,000,000 tons of cottonseed of a value between $100,000,000 and $400,000,000, depending upon the market price. The yield of cottonseed oil is from 160,000,000 to 200,000,000 gallons, worth from $70,000,000 to $200,000,000, depending somewhat upon prices. Correspondingly, India plants about 20,000,000 acres to cotton in an ordinary year, yielding about 3,200,000 bales (of 500 pounds), from which are obtained about 2,000,000 tons of seed. The use made of the seed varies a great deal from year to year, as in time of scarcity much of it is used for cattle feed. About 10 per cent of the crop is retained for planting and about an equal amount is ordinarily fed to live stock.

Clearly India can not afford to sacrifice a valuable asset, and if Indian seed were equal in quality to American seed it seems certain that India would now have a well-established cottonseed-oil industry. But the seed is inferior, with the result noted. On the other hand, a little has been done in connection with this matter, as is shown by the following figures for exports of cottonseed oil from India:

Years.	Quantity.	Value.	Years.	Quantity.	Value.
	Gallons.			*Gallons.*	
1913-14	2,507	£347	1917-18	76,308	£9,595
1914-15	12,471	1,059	1918-19	9,356	1,183
1915-16	43,030	4,031	1919-20	132,486	38,643
1916-17	84,156	10,004	1920-21	18,977	6,312

There is just enough business here to suggest that the industry is susceptible of real development—a conclusion that is supported by the following record of the exports of cotton seed, practically all of which went to the United Kingdom (apparently the shipments fell off when the freight rates became too high):

Years.	Quantity.	Value.	Percentage to the United Kingdom.	Years.	Quantity.	Value.	Percentage to the United Kingdom.
	Tons.				*Tons.*		
1913-14	284,327	£1,416,743	98	1917-18	1,675	£9,587	0
1914-15	207,789	1,004,524	97	1918-19	1,454	11,810	0
1915-16	95,664	445,077	98	1919-20	248,749	3,655,628	98.2
1916-17	39,630	203,940	94	1920-21	69,900	1,036,495	98.5

Indian cotton seed is valued in Europe on the basis of 18 per cent oil, but on the average the yield from Indian seed is considerably lower and in Burma the oil content is normally assumed to be only 10 per cent. American seed contains upward of 30 per cent. It is therefore plain that the cottonseed-oil business in India will be a very different trade from that known in the United States. In addition to

this difference in the oil value of Indian seed it seems that the individual seed is only about 30 to 50 per cent of the size of the American seed and suffers a further handicap in that it is a fuzzy seed having an inner layer of fluff or lint besides the outer layer of true cotton fiber. As it has not been the custom to either delint or decorticate these seeds in treating them for oil recovery it is plain that the lint will absorb a substantial amount of the oil. (Most Indian cotton is ginned in roller-type rather than saw-type gins, and this fact also influences the problem of oil recovery.)

It is therefore apparent that Indian seed is now used in the United Kingdom as a source of supply for cottonseed oil. In view of the fact that a small amount of the same business has been conducted in India for many years, this indicates that the industry has actually been proven to be practical and commercial. On the other hand, it is undoubtedly a very different industry from that known in America. It is probable that the industry in India will grow to much greater importance than at present, and Americans should be better able than any other nationality to solve the mechanical and technical problems connected with it, in view of the extensive experience of American machinery manufacturers. At the same time the problem in India will probably be found to involve many conditions not found in the United States and will need to be handled with care. The situation seems to imply that the extraction should be carefully checked by competent chemists and will call for very scientific supervision—a requirement that was not met in any plant of any kind visited by the writer in India, with perhaps two exceptions.

OTHER VEGETABLE OILS.

In addition to cotton seed India produces a very important amount of a number of other oil nuts and seeds, the total export of which probably amounts to 1,500,000 to 2,000,000 tons per year, besides the important domestic consumption of oils and seeds. The oils extracted locally are often secured by primitive processes, but in a number of instances there are reasonably modern mills which have been a commercial success for a number of years. It is believed that competent Americans could offer improved methods and machinery and that there is a distinct opportunity for the sale of American machinery for these purposes in India, though it also seems certain that unusual problems will confront those who undertake this business.

The position of India in the supply of oil-bearing seeds in international trade is indicated as follows:

Kinds.	Total exports from producing countries.	Exports from India. 1913-14.	India's percentage of world exports.
	Tons.	*Tons.*	
Linseed	1,808,000	414,000	23
Peanut	779,000	364,000	46
Cotton seed	858,000	284,000	33
Rape and mustard seed	385,000	254,000	66
Castor seed	135,000	135,000	100
Sesame seed	264,000	112,000	42
Copra	537,000	38,000	7
Mowra seed	33,000	33,000	100
Poppy seed	25,000	19,000	76
Niger seed	4,000	4,000	100

Practically all of the above exports went to Europe, about one-third going to the United Kingdom and large amounts to France and Germany. It would seem possible to improve greatly the present oil-mill industry; this includes some plants of modern type, but the bulk of the work is done in bullock-driven mills of a primitive type which are very inefficient.

The following table shows the 1913–14 exports of vegetable oils extracted in India:

Kinds of oil.	Quantity.	Value.	Principal countries of destination.
	Gallons.		
Coconut oil	1,091,477	£155,073	United States, United Kingdom, Germany, Sweden, Belgium, Netherlands.
Castor oil	1,077,001	92,504	Australia, New Zealand, Straits Settlements, Mauritius, United Kingdom, Ceylon.
Mustard and rape oils	407,178	48,624	Mauritius, Natal, Fiji, British Guiana.
Peanut oil	288,190	30,013	Ceylon, Mauritius, France.
Sesame oil	208,053	28,699	Maskat, Aden, Ceylon, German East Africa.
Linseed oil	102,360	17,493	New Zealand, Hongkong, Australia, United Kingdom.
Cottonseed oil	2,507	347	United Kingdom.
Other vegetable oils	135,321	12,900	Germany, Belgium, Ceylon, United Kingdom.

India in the same year exported about £1,000,000 worth of oil cakes, most of which went to the United Kingdom, Ceylon, and Japan. The United Kingdom absorbed about 32,000 tons of peanut oil cake (chiefly for cattle feed) out of a total of 62,000, and Japan 45,000 tons of rapeseed oil cake for use as a fertilizer.

But the total export trade as indicated by the above tables is a very inadequate indication of the Indian demand for vegetable oils and of the extent to which it seems probable that modern machinery could be employed in extracting them—because a great quantity is absorbed in the domestic trade of India. It is very difficult to estimate the amount consumed in this way, but it is very large. Returns are available giving the acreage and yield of these crops, but the disturbances during the last five years resulting from the war make it impossible to analyze the situation satisfactorily. It is anticipated that, under the more methodical régime recently introduced, better agricultural methods in the production of these seeds (and also probably better methods of extraction) will be employed. Probably large-scale mills of a modern type could be used very advantageously in connection with this domestic trade, but the success of these mills in producing oils for export depends as much on the tariff policy of the importing countries as upon the improvements made and efficiency shown. The Indian Industrial Commission recommended measures that are intended to provide scientific and economic assistance to the seed-growing and oil-extracting industries.

In addition to the oil-bearing seeds mentioned above, it should be added that a demand may be expected to develop for machinery as used in the production of oil from rubber seeds on the rubber plantations of India, the acreage of which totals about 125,000, as compared with 220,000 in Ceylon, 500,000 in the Malay Peninsula, and 400,000 in the Dutch East Indies, as well as for extracting palm oil and palm-kernel oil from the fruits of the African oil palm, which is being introduced on plantations in this part of the world, and tea oil, which is produced in quantity in China but probably has not yet been produced in India.

JUTE INDUSTRY.

Just as the cotton-textile industry centers around Bombay, the jute industry is confined to those parts of the country reached through Calcutta, but with the important difference that India practically monopolizes the production of this fiber—the cheapest of all commercial fibers. The industry is so large that it is the most important in India excepting only the cotton industry. Jute is grown mostly on the wonderfully fertile land in the alluvial valleys of the Ganges-Brahmaputra delta, probably among the most fertile areas in the world, with plenty of rain (about 56 inches) and ample labor. It seems strange that such desirable areas should be devoted to the production of such a low-quality material.

All jute appears to be spun and woven either in India or in Dundee. Scotland. Originally jute was spun and woven by hand in India, but in 1838 the flax and hemp spinners of Dundee began to use jute, manufacturing fabrics on power looms. In spite of the fact that the hand-weaving industry of Bengal showed great vitality, it ultimately felt the force of this competition and has disappeared, although hand spinning still continues. For a good many years Dundee has absorbed about 1,200,000 bales (400 pounds each) except when war interfered.

The first power mill to spin jute in India was started in 1855 and the first weaving mill in 1859. The following table represents the growth of the industry since that time.

Years.	Number of mills at work.	Number of employees.	Number of looms.	Number of spindles.
1879–80 to 1883–84	21	38,800	5,500	88,000
1884–85 to 1888–89	24	52,700	7,000	138,400
1889–90 to 1893–94	26	64,300	8,300	172,600
1894–95 to 1898–99	31	86,700	11,700	244,800
1899–1900 to 1903–4	36	114,200	16,200	334,600
1904–5 to 1908–9	46	165,000	24,800	510,500
1909–10	60	204,100	31,400	645,900
1910–11	58	216,400	33,100	682,500
1911–12	59	201,300	32,900	677,500
1912–13	61	204,000	34,000	708,700
1913–14	64	216,300	36,000	744,300
1914–15	70	238,300	38,400	795,500
1915–16	70	254,100	39,900	812,400
1916–17	74	262,500	29,600	824,300
1917–18	76	266,000	40,600	834,000
1918–19	76	270,000	39,300	823,700

By this time the capital invested in these mills had risen to 144,720,000 rupees and the mill consumption (1917–18) had risen to 5,447,000 bales, compared to an export of 1,756,000 bales (in war time; it had been 4,340,000 in 1913–14). For 1918–19 India exported 583,096,000 gunny bags, 1,103,211,000 yards of burlap cloth, and 7,000 tons of other jute products, in addition to an export of 2,229,627 bales of raw jute, which went to the United Kingdom, the United States, France, Italy, Spain, and some other countries. Before the war Germany and Austria also absorbed important quantities.

On March 1, 1916, the Government of India levied an export duty on raw jute of 2 rupees 4 annas per bale of 400 pounds, or approximately 5 per cent, and similar duties on manufactured jute. In view of the protective policy of the Government, this important industry will probably be encouraged as much as possible, even though mills in other countries suffer.

Entirely apart from the spinning and weaving equipment that form the major part of the machinery used in the jute mills of Calcutta and the cotton mills of Bombay, there is a very large amount of accessory equipment and the supply of belting, lubricants, etc., is a large and regular trade.

GINNING AND PRESSING FACTORIES.

Related to the jute and cotton mill industries of India and yet in a sense independent of them are the factories where cotton is ginned and baled or, correspondingly, the establishments where jute is baled. Altogether there are a very large number of these pressing factories, the number and relative importance being suggested by the following figures representing the year 1917:

Industries.	Number of factories.	Number of employees.
Cotton spinning and weaving mills	284	282,297
Jute mills	75	264,373
Cotton ginning and pressing factories	1,775	133,323
Jute presses	125	25,504

(There are slight discrepancies between the figures in this table and those used elsewhere—representing the difference between the returns for the calendar and those for the fiscal year. The above returns are for the calendar year 1917, except that the number of gins is for the ginning season 1918–19.)

Cotton is probably the most important single crop in India except food grains. In 1918–19 cotton represented 42 per cent of the total exports of Indian merchandise from the Bombay Presidency, and in 1913 India produced about 15 per cent of the world's cotton crop. The staple produced is of a great many varieties, and it is probably safe to say that cotton is grown in every Province, so that the ginning and pressing plants are scattered widely, the principal districts being represented as follows:

Districts.	Number of plants.	Number of employees.	Districts.	Number of plants.	Number of employees.
Bombay Presidency	521	39,014	Punjab	120	7,728
Central Provinces and Berar	426	27,660	Central India	107	8,563
United Provinces	156	14,214	Hyderabad	147	8,152
Madras Presidency	149	12,915	Baroda	83	6,260

This leaves 66 plants and 8,817 employees in the other parts of India. It will be noted that on the average these plants for all of India employ 75 persons.

In contrast to the cotton industry, the jute presses are concentrated, being located as follows:

District.	Number of plants.	Number of employees.
Bengal	117	24,848
Bihar and Orissa	4	454
Madras Presidency	4	202
Total	125	25,504

On the average these plants employ 204 persons.

The differences in regard to the ginning, baling, and pressing are almost as many as the varieties of cotton grown. In the Punjab and Burma, for instance, the ginners buy the seed cotton; elsewhere they mostly gin on commission. In the south of India, however, where the ginners are also exporters, they buy only the lint after ginning. The greater part of the crop is machine ginned, but (except in Dharwar, where the American saw gin is used) chiefly with roller gins. In many of the more important cotton-growing centers the big European cotton exporters have their own gins.

"Though the loose bundles of ginned cotton, if intended for Indian mills, are sometimes only half pressed, the bulk is steam-pressed in steel-hooped bales up country and so railed down to the port. The density of pressing varies from 45 to 65 pounds per cubic foot."[12]

The use of the roller gin in India again introduces the question of labor. It is said that because of the shortness of the staple of Indian cotton it is much better to use the roller type of gin, but it also seems to be difficult to persuade the workmen to maintain the saws. So long as the saws are sharp it seems that this type of gin gives the better result, but when the men relax their efforts and the saws are dull the fiber suffers correspondingly. In 1917 there were 41,621 gins in India, of which 30,863 were active.

The baling of jute seems to be a very simple process. Unlike cotton, there is very little loss in weight in cleaning and baling jute for market. The standard bale is 400 pounds.

RICE MILLS.

Rice milling also illustrates some peculiar differences as to the way in which a given problem is handled in several territories.

It has been estimated that India produces about 40 per cent of the world's yield of rice, or possibly 36,000,000 tons per year—a truly magnificent total. Also, India is the largest exporter of rice in the world, shipping from 1,300,000 to 2,400,000 tons per year. Burma contributes the greater part of this export total and is in an excellent position to do so, as rain failure is unknown there. But it should also be remembered that Bengal, Bihar, and Madras grow more rice than Burma, though they export less because of the greater domestic consumption. As the yield per acre is low as compared with Japan and Egypt, the acreage is high, and, altogether, the crop is probably planted on about 80,000,000 acres.

In former times in certain districts rice was polished, among other ways, by plunging a wooden pestle onto the rice contained in the equivalent of a mortar. Sometimes this was operated by a primitive water wheel, but more often by foot power. When carefully handled this method produced a very attractive, highly polished grain. But as the method involved a great deal of labor, it is disappearing with the rising standards of living in Asia. As a substitute, some simple machines have been devised which aim to polish the rice quickly by power. These simple devices are not altogether successful, for although they improve the appearance of the rice there also seems to be a good deal of breakage, and broken grains result in a lower price. A certain American make of rice huller and polisher that is

[12] From "Handbook of Commercial Information for India," p. 124.

a more perfect design than those just mentioned is very popular in most of the Indian markets and commands a big sale. In other districts—as, for instance, in the Philippines—more elaborate units are employed, where the rice is subjected to possibly three operations in the cleaning and polishing process. Even these installations can scarcely be called mills, though the various machines are often connected by a set of steel framework with appropriate conveying equipment. On the other hand, the rice mills in Burma are often very large plants, giving much the same impression as an American flour mill of 500 to 1,000 barrels capacity. The largest of the Burma mills will turn out 700 tons of rice a day with about 1,350 employees.

In these large mills the rice is first run over shakers and sieves to remove stones, dirt, straw, etc., this being followed by a winnowing process. Next it is passed between grinding stones, which remove the husk, and is again winnowed. In some instances the rice is marketed in this condition. For white rice it is further milled by cones which remove what might be called the bran, following which it is carefully sifted so as to remove the broken grains. In some cases the rice is again winnowed and bagged, but for the higher qualities it is subjected to further polishing in cylinders of wood and wire gauze in which revolve rollers covered with sheepskin, following which it is again sifted. It will be plain that such a process constitutes a genuine milling operation and is not to be compared with the simple processes mentioned above. Because of the care and gentler treatment at each operation the products of these mills should be better and the percentage of breakage less than in installations where an effort is made to complete the process in a single operation. For these reasons it is very desirable that a clear distinction be drawn between the different types of "mills" used. The larger plants in the Rangoon district are the most elaborate seen anywhere; nothing of this type was seen in Japan, China, or the Philippines, although the larger installations in French Indo-China, at Saigon, show a tendency to follow the same principles that are used in Burma. The following classification shows the distribution of rice mills in India:

Provinces.	Mills having more than 100 employees.		Mills having fewer than 100 employees.	
	Number of mills.	Number of employees.	Number of mills.	Number of employees.
Bengal	1	200	61	2,506
Bihar and Orissa	....	....	8	273
United Provinces	....	....	1	22
Punjab	....	....	2	118
Burma	68	25,710	251	9,096
Madras	16	2,877	113	5,731

The grand total for British India is 521 mills, employing 46,533 persons; in addition there were about 10 mills, some of fair size, not operating. Of the above, about 15 mills were combined with sawmills or other enterprises, and this fact probably raises the number of employees a little. In addition, in the Native States there are

20 small rice mills employing 551 persons, but no one of these plants employs more than 60 persons, and 19 of them are in Hyderabad.

ENGINEERING WORKSHOPS.

According to the returns of the 1917 list of "Large Industrial Establishments in India" (published in 1920) the classification next in importance after "Rice mills" covers the "Engineering workshops," in which are included "electrical engineering workshops, shipbuilding and engineering works, iron and brass foundries, and canal foundries and workshops." The classification excludes plants producing "arms and ammunition," of which there are 17; "dockyards and port-trust workshops," of which there are 15; "iron and steel producing works," of which there are 2; and "railway and tramway workshops," as follows:

Shops.	Number of establishments.	Number of employees.
Engineering workshops	161	39,112
Arms and ammunition	17	33,287
Dockyards and port-trust workshops	15	23,031
Iron and steel producing works	2	17,145
Railway and tramway workshops	97	115,529
Total	292	228,104

If it is correct to consider the above group as a unit, it is clear that establishments of the above types constitute an industry that is one of the most important in India, for if importance is measured by the number of employees it ranks ahead of all except the cotton and jute mills. Also, as an industry it is of peculiar interest to the American manufacturer of machinery.

The railway and tramway workshops are owned by the various lines and located at convenient points, thereby being distributed over the entire country to a greater or less extent. In some cases the Government owns the railway and also the workshops. In other instances the line is owned by one of the native States. There are also a large number of lines owned by private corporations. Some of these shops are quite large and well equipped; for instance, the East Indian Railway shops at Jamalpur (Bihar and Orissa) employ more than 11,000 hands. At least one shop has built complete locomotives. The railway shops owned by the Government are distributed as follows:

Provinces.	Number of shops.	Number of employees.	Provinces.	Number of shops.	Number of employees.
Assam	1	24	Ajmer-Merwara	2	9,082
Bengal	5	6,994	Baluchistan	1	239
United Provinces	3	4,884			
Punjab	7	2,094	Total	19	33,317

The only railway shop operated by the government of a native State is the one at Jodhpur, in Rajputana, employing 1,538 persons.

The railway shops that are operated by companies are distributed as follows:

Provinces.	Number of shops.	Number of employees.	Provinces.	Number of shops.	Number of employees.
Bengal	9	15,098	Punjab	1	94
Burma	3	2,363	Central Provinces and Berar	3	1,061
Assam	2	703	Madras Presidency	19	14,510
Bihar and Orissa	4	11,675	Bombay Presidency	17	23,843
United Provinces	7	7,541			
Dellir	1	125	Total	66	77,013

In addition, there are three shops not provided with power, employing 1,032 persons, and the tramways in the several leading cities have eight shops and 2,629 employees.

The two iron and steel plants that were in operation at that time have already been mentioned.

The Government has three dockyards in Bengal with 4,085 employees and one in Bombay with 4,898 employees. Private interests have five dockyards in Bengal with 5,098 employees, two in Bombay with 6,061 employees, and two in Burma with 2,273 employees. The shops connected with the harbors at Madras and Rangoon have 616 employees and those at Bombay 1,004.

The facilities for producing munitions are suggested by the following:

Establishments.	Employees.	Establishments.	Employees.
Aircraft workshop at Peshawar	132	Arsenals—Continued.	
Ammunition factory at Dum-Dum	3,742	Allahabad	900
Gun and shell factories:		Rawalpindi	890
Cossipore	5,859	Ferozepur	1,143
Ishapur	6,649	Rangoon	160
Rifle factory, Ishapur	4,523	Quetta	746
Ammunition factory at Kirkee, Poona	2,870	Army clothing factories:	
Cordite factory at Nilgirus	1,353	Patua	200
Arsenals:		Shajahanpur	1,073
Kirkee, Poona	475	Alipore	473
Madras	419	Madras	1,246

The Government also has 16 engineering workshops; the largest has 419 employees, and the total is 2,724.

The iron and brass foundries of India total 48, with 7,939 employees. The largest individual plant is the Byculla Iron Works at Bombay, which, with accompanying machine shops, employs 958. The distribution is as follows:

Districts.	Number of foundries.	Number of employees.	Districts.	Number of foundries.	Number of employees.
Burma	6	1,404	Dellir	2	133
Bengal	12	467	Bombay Presidency	14	3,483
Bihar and Orissa	2	55	Madras	5	1,038
United Provinces	3	662			
Punjab	4	697	Total	48	7,939

Six of these foundries are combined with other industries—a dockyard, a rice mill, an ice factory, two machine shops, and a rope shop. Correspondingly, the report mentioned above lists 66 "engineering workshops" with 16,683 employees. These machine

shops are mostly found in Bengal, and in Bihar and Orissa. The distribution is indicated below:

Districts.	Number of shops.	Number of employees.	Districts.	Number of shops.	Number of employees.
Bengal	43	7,980	Madras	3	296
Bihar and Orissa	5	[1] 5,223	Burma	6	410
United Provinces	3	870			
Bombay	6	1,904	Total	66	16,683

[1] The Kumardhubi Engineering Works at Maublum employs 4,863 and is the largest single shop of its kind in India.

India is expected to show very rapid development in the direction of machinery production. The situation in the past is indicated by the following quotation from the report of H. Burkinshaw, controller (electrical and mechanical) Indian Munitions Board, which was written about the end of 1918. This report reflects between its lines the problems confronting the board in time of war and the desire to stimulate industry in India for times of peace, particularly in the direction of restricting imports:

At the outbreak of war India found itself singularly ill equipped to cope with its own demands for mechanical and electrical machinery and appliances. Large imported stocks were, however, available, and these, for some time, served to relieve a situation which might otherwise have been disastrous.

The reduction in imports of all manufactured goods necessarily increased the pressure upon Indian factories, and this, in turn, created a very large demand for machine tools, without which it was impossible to manufacture new machinery and spare parts for existing machinery. These machine tools were supplied almost exclusively from imported stocks, but a number of the simpler kinds were manufactured to meet very urgent cases. Hitherto, private enterprise does not appear to have attempted to manufacture machine tools capable of working with that degree of precision and speed demanded by modern methods. That such machinery can be produced in India has been clearly demonstrated, and notable examples are the exceptionally high-class lathes manufactured in the Lilooah workshops of the East Indian Railway. The manufacture of machine tools in India is of the utmost importance, as, without them, no other machinery can be produced and all industry must be hampered. It is fortunate, therefore, that the manufacture of machine tools in India is likely to be established in the near future.

Heavy machinery requiring no great degree of precision in manufacture, such as slow-speed steam engines, hydraulic presses, pumps, looms for coarse fabrics, mortar mills, colliery haulages, etc., is readily manufactured in India, and many such machines are in successful operation. Several engineering firms have now standardized these machines, and their productions are at least equal to those previously imported. It has been possible to comply not only with the normal demands but also with those from the army, and there appears to be no reason why the import of this class of machinery should again rise to its pre-war value.

Portable engines, traction engines, and road rollers are not manufactured in India. Small vertical and Lancashire-type boilers have been made in rare cases, but the total output is small enough to be practically negligible. This type of machinery is required in large quantities, and India is dependent entirely upon imports.

Before the war, engineering firms in India principally concerned themselves with the nonrecurring demands for machinery not usually imported, millwrighting, repair work, and steel structural work. They have since had to turn their attention to the manufacture of a diversity of machines and parts of machines for which their workshops were imperfectly equipped. The results obtained reflect great credit upon the perseverance and ingenuity of individuals, and it has generally been possible to obtain from them anything which was of vital urgency. But, in the present state of industrial development in this country, these efforts must be regarded for the most part as tours de force and, when

peace conditions return, for a time at any rate, India must expect to a great extent to fall back to her pre-war dependence on imported machinery. The reason of this is obvious. Modern engineering works use largely certain products which they do not themselves manufacture. Amongst these are pig iron, mild steel tubes, wire, plates, and sections, copper and brass rods, tubes, bright-machined screws and nuts, wood screws, split pins, washers, tool steel, twist drills, cutters, springs, etc. With the exception of pig iron and mild steel sections, engineers in India are dependent for all these almost entirely upon imports, and until these conditions are altered the manufacture of machinery to meet the very large demands can not well be undertaken.

The manufacture of electrical machinery, such as dynamos, motors, transformers, etc., has not been attempted in India on account of the difficulty of obtaining the requisite material. The principal materials required are cast iron of high permeability, mild steel, thin iron plates with special magnetic properties, copper wire, copper bars of special sections, cotton yarn and tape, mica, press-spahn, and certain varnishes, in which shellac is usually an ingredient. After experiment it would doubtless be possible to produce suitable cast iron, but there is no immediate prospect of producing from indigenous sources the thin iron core plates, electrolytic copper wire and sections, cotton yarn and tape, and press-spahn. The cotton tape and yarn required must be made from fine counts, entailing the use of long-staple cotton, and the finished product must be entirely free from dressing and of uniform dimensions. This has not yet been produced in India.

A certain amount of switch gear for direct current has been manufactured in India during the war, and the results reflect great credit upon the firms concerned, the gear comparing very favorably with similar imported articles. The difficulties of manufacture have been great, as, with the exception of pig iron for the castings, recourse has had to be made to imported copper sheets, brass bars, etc., and in almost every case it has been necessary to utilize such material as was obtainable rather than that which would normally have been used. All small pins, screws, nuts, springs, and washers have had to be manufactured, either by hand or upon unsuitable machinery, and this has resulted in increased cost of production and the sacrifice of interchangeability.

A notable achievement has been the successful production of electrical porcelain, the insulators now produced in India being in every way equal in quality to the usual imported types. None were made in India before the war, and if the existing factory is extended to supply insulators in large quantities there appears to be no reason why the import of this article should not cease. If electrical porcelain becomes readily available, factories could be established for the manufacture of such accessories as ceiling roses, tumbler switches, wall plugs, cut-outs, distribution fuses, etc., all of which are at present imported.

All such electrical fittings as water-tight lanterns, deck fittings, ironclad plugs and sockets, hand lamps, table lamps, plain glass globes, and the like are now manufactured in sufficient quantities to meet the present curtailed demand. In many cases they are superior to the imported article, and only in rare instances is there a marked inferiority.

No attempt has been made to produce insulated conductors and insulating material (except porcelain), and the whole of the requirements have been met from imported stocks. The rubber now produced in southern India, however, is of a very high grade and eminently suitable for electrical purposes, and there is no insurmountable obstacle to be overcome for the production in India of all types of insulating materials and insulated conductors.

Although manufacturing firms have at present to depend so largely on imported materials for their work, practically all the raw materials required for mechanical and electrical engineering manufacturers are indigenous to India, and there is no reason why these resources should not be developed. Mills for the production of steel, copper, and brass plates, rods, tubes, and wire are urgently required, and also the establishment of works for the production in bulk of machined bolts and nuts, screws, gudgeon pins, washers, split pins, etc. * * * There are excellent prospects of many of these products being manufactured in India in the near future, and should these materialize, the manufacture of practically all types of machinery and electrical appliances could be undertaken with a certainty of success.

There remains the labor factor, and it is satisfactory to note that the results obtained in the State workshops (which have not been mentioned in this note as

their resources are not usually directly accessible to the public), and in up-to-date privately owned shops demonstrate that the Indian workman can produce work of a markedly high quality when he is given proper facilities. It is true that expert labor is not equal to the demand, and this will no doubt at first hamper the expansion of the engineering industries. But the capacity is there, and the lessons which the Indian will learn from the imported skilled artisan and the training and education which he will receive, if the recommendations of the industrial commissions are carried out, should result in time in the provision of an ample indigenous labor force.

To sum up, the engineering manufacturing resources of India are not yet sufficiently developed to compete with imported machinery, but the possibilities for development are enormous, most of the raw material is available, the labor can either be procured or trained, and the market for the products is assured. It remains for private enterprise to avail itself of its opportunity.

Mr. Burkinshaw's interesting statement shows clearly how the situation stood a year before the armistice, but he seems to underestimate India's absorption of machine tools, as the £84,559 of metal-working machinery imported in 1919–20 is far above the £9,731 absorbed in 1913–14, and indicates that the industrialization of India will proceed much faster than he anticipated, creating a demand for machinery far beyond the present resources of the country. The truth appears to be that India—in fact, Asia—is developing much more rapidly than is generally realized either there or in the countries of the Occident, and this development will probably be the outstanding feature of the next two decades.

SUMMARY OF INDUSTRIAL DEVELOPMENT TO JANUARY 1, 1918.

In presenting the above brief descriptions of some of the leading industries of India an effort has been made to show the present stage of development that has been reached. Inevitably such a description is unsatisfactory. In such a large and well-populated territory, with splendid resources, one would expect to find greater development, and yet some persons seem to feel that in the "unchanging East" there would be no progress worth mentioning. Neither extreme is representative of the facts. There has been a great deal of progress, and there is reason to believe that a period of rapid development has recently started. The following table shows all of the industries in British India and the Native States, together with the average daily number of operatives employed therein during 1917:

Class of establishments.	British India.				Indian States.				Total.	
	Owned by Government and local bodies.		Owned by companies or individuals.		Owned by State darbars.		Owned by companies or individuals.			
	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.
Textiles:										
Clothing agencies	7	3,967							7	3,967
Cotton mills	1	685	243	259,820	1	845	30	20,058	275	281,408
Cotton spinning and weaving establishments not classed as mills			7	834	1	55	1		9	889
Hosiery factories			3	136			1	136	4	272
Jute mills	1	595	74	263,778					75	264,373
Shawl weaving establishments							4	406	4	406

Class of establishments.	British India.				Indian States.				Total.	
	Owned by Government and local bodies.		Owned by companies or individuals.		Owned by State darbars.		Owned by companies or individuals.			
	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.
Textiles—Continued.										
Silk mills			45	3,337			1		46	3,337
Tent factories			3	595					3	595
Woolen carpet weaving establishments			6	1,142			2	1,760	8	2,902
Woolen mills	1	150	4	7,039			1	531	6	7,720
Woolen weaving factories					2	124			2	124
Miscellaneous			12	1,461					12	1,461
Total, textiles	10	5,397	397	538,142	4	1,024	40	22,891	451	567,454
Minerals:										
Aluminum factory			1	93					1	93
Colliery workshops			2	185					2	185
Gold washing works							4	698	4	698
Iron and brass works and foundries	3	830	57	8,297					60	9,127
Iron and steel producing works			2	17,145					2	17,145
Lock and cutlery works			6	1,130					6	1,130
Metal works			20	1,011					20	1,011
Petroleum refineries			7	11,556					7	11,556
Miscellaneous			7	1,306					7	1,306
Total, minerals	3	830	102	40,723			4	698	109	42,251
Transport:										
Aircraft workshop	1	132							1	132
Dockyards	4	8,983	9	13,432					13	22,415
Harbor works	1	426							1	426
Port trust workshop	1	190							1	190
Railway workshops	19	33,317	69	78,045	1	1,538			89	112,900
Shipbuilding and engineering works			11	8,533					11	8,533
Tramway works			8	2,629					8	2,629
Miscellaneous			1	200					1	200
Total, transport	26	43,048	98	102,839	1	1,538			125	147,425
Food, drink, and tobacco:										
Bakery	1	89							1	89
Biscuit factories			3	169					3	169
Breweries			17	1,923					17	1,923
Coffee works			14	4,273					14	4,273
Dairy farms	8	863	1	70					9	933
Distilleries	2	192	10	866	1	86	3	316	16	1,460
Flour mills			44	4,452			4	105	48	4,557
Ice, mineral and aerated water factories			19	1,232	1	23			20	1,255
Opium factories	1	1,559							1	1,559
Rice mills			522	46,563			20	551	542	47,114
Sugar factories			36	9,589			4	258	40	9,847
Tobacco firms and factories			14	5,901					14	5,901
Miscellaneous			45	5,046			3	626	48	5,672
Total, food, drink, and tobacco	12	2,703	725	80,084	2	109	34	1,856	773	84,752
Chemicals, dyes, etc.:										
Bone crushing mills			13	1,703					13	1,703
Chemical works			8	1,485			1	40	9	1,525
Dye works			16	3,152			3	465	19	3,617
Lac factories			58	4,753			1	571	59	5,324
Oil mills			126	6,752			12	1,005	138	7,757
Paint works			2	689					2	689
Soap factories			2	242					2	242
Miscellaneous			7	1,905			1	55	8	1,960
Total, chemicals, dyes, etc			232	20,681			18	2,136	250	22,817

Class of establishments.	British India.				Indian States.				Total.	
	Owned by Government and local bodies.		Owned by companies or individuals.		Owned by State darbars.		Owned by companies or individuals.			
	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.
Paper and printing:										
Bookbinding works			2	514					2	514
Paper mills			7	5,147			1	260	8	5,407
Printing presses	32	13,221	109	16,752	3	286	4	479	148	30,738
Total, paper and printing	32	13,221	118	22,413	3	286	5	739	158	36,659
Processes relating to wood, stone, and glass:										
Carpentry	2	240	8	810					10	1,050
Cement works			2	464					2	464
Coach building and motor-car repairing works			25	3,155					25	3,155
Furniture workshops			7	469	1	50			8	519
Glass factories			5	454			1	50	6	504
Lime works			18	3,364					18	3,364
Potteries			8	3,269			1	90	9	3,359
Sawmills			125	11,372	1	150	1	150	127	11,672
Stone works			40	4,512			8	4,420	48	8,932
Tile and brick factories	1	72	172	20,015			9	3,109	182	23,196
Miscellaneous			2	628					2	628
Total, processes relating to wood, stone, and glass	3	312	412	48,512	2	200	20	7,819	437	56,843
Processes connected with skins and hides:										
Leather factories	1	3,470	12	5,688			2	160	15	9,318
Tanneries	3	492	307	17,925			9	475	319	18,892
Miscellaneous			2	265					2	265
Total, processes connected with skins and hides	4	3,962	321	23,878			11	635	336	28,475
Miscellaneous:										
Arms and ammunition	6	24,996							6	24,996
Arsenals	7	4,733							7	4,733
Brush works			3	819					3	819
Canal foundries and workshops	2	614							2	614
Cotton ginning, cleaning, and pressing mills			1,409	108,292	2	768	364	24,263	1,775	133,323
Dispatch box manufactories			3	594					3	594
Electrical engineering workshops	1	50	2	140					3	190
Engineering workshops	17	3,728	66	16,683	2	237			85	20,648
Forage presses	6	591							6	591
Galvanizing works			2	244					2	244
Gas works	1	145	4	1,228					5	1,373
Gun carriage factory	1	3,117							1	3,117
Jewelry workshops			2	479					2	479
Jute presses			125	25,504					125	25,504
Kerosene tinning and packing works			23	6,290					23	6,290
Manure works			3	354					3	354
Match factories			6	783					6	783
Mathematical instrument factory	1	353							1	353
Mechanical transport repair workshop	1	175							1	175
Mints	2	2,777							2	2,777
Motor works			3	470					3	470
Municipal workshops	7	1,161							7	1,161
Postal workshop	1	155							1	155
Rope works			17	3,228			9	1,547	26	4,775
Rubber works			1	50			11	5,035	12	5,085

Class of establishments.	British India.				Indian States.				Total.	
	Owned by Government and local bodies.		Owned by companies or individuals.		Owned by State darbars.		Owned by companies or individuals.			
	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.	Number.	Persons.
Miscellaneous—Contd.										
Sappers' and miners' workshop	1	134							1	134
Silk filatures			11	588			3	2,427	14	3,015
Stores factories	2	329							2	329
Surgical instrument factory			1	180					1	180
Telegraph works	2	790							2	790
Umbrella factory			1	58					1	58
Water works	10	931							10	931
Miscellaneous (not enumerated above)	3	180	32	2,579	1	150	11	3,785	47	6,694
Total, miscellaneous	71	44,959	1,714	168,563	5	1,155	398	37,057	2,188	251,734
Grand total	161	114,432	4,119	1,045,835	17	4,312	530	73,831	4,827	1,238,410

NOTE.—Figures in some cases do not agree with those published in the "Statistics of British India, Vol. I—Commercial, 9th issue," because of the inclusion of revised figures subsequently received.

The total number of gins in the cotton ginning factories in British India and in the Indian States in 1917 were, so far as information could be procured, 31,883 and 8,653, respectively, of which 23,164 in British India and 7,048 in the Indian States were reported to be at work during the ginning season 1918-19.

A total of 4,827 factories, employing 1,238,410 persons, represents a very considerable industrial development. It is regretted that it is necessary to offer particulars covering a year so far back as 1917, but as these data were published in 1920 they represent the latest details obtainable. For purposes of comparison hereafter it may be interesting to add that in 1917 the number of factories inspected under the factory act was 3,241, with 1,076,201 employees. In 1918 this had become 3,318 factories, with an average of 1,123,072 employees, and these returns are the most recent available, being published in the "Statistical Abstract Relating to British India" issued in 1921.

INDUSTRIES IN COURSE OF DEVELOPMENT.

The above statements cover only the industries that have actually been developed, representing the concrete accomplishment in this territory, but the statement is not complete without reference to those things that are in course of development. As has been pointed out, the Government and other interests are devoting a great deal of energy to new projects. It will require some years for the new organization made up of the provincial departments of industries and the various committees to show the full effect of the plan, but the plan is at work and it would be a serious error to estimate the future of industry in India entirely from what can be seen from statistics showing its past achievements. India is profoundly impressed by what it has observed of the effects of Government guidance for industry in Japan and to a greater or less degree will be guided by the example of that most successful Asiatic country, where the problems that have been faced bear a certain resemblance to those that India still has to meet. "The success of Japan in its war with Russia appealed strongly to the imagination of educated Indians, who saw in Japanese progress

and efficiency an example of what could be accomplished by an eastern nation. It was to the policy of the Japanese Government that the great industrial advance of Japan was ascribed by them."[13] India is now leaning heavily on its Government for guidance in matters relating to industrial development, and the Government is making a great effort to respond. The directions in which this effort is being exerted are far too numerous to repeat here, but a few examples will be considered.

HYDROELECTRIC DEVELOPMENT.

The following table is a summary of the water-power development that had been attained in India up to 1919, the statement of existing hydroelectric plants being abstracted from the "Preliminary Report on the Water-Power Resources of India":

Provinces.	Undertaking.	Capacity installed in electric horse-power.	Proposed ultimate capacity in electric horse-power.
Bengal	Darjeeling municipality	600	600
Bombay Presidency	Bhatghar dam	300	3,000
Do	Gokak Water Power Co	2,100	....
Do	Tata Hydroelectric Power Supply Co	67,000	67,000
Burma	Burma ruby mines	560	560
Do	Kanbank wolfram mines	500	750
Kashmir	Jammu	910	1,340
Do	Jhelum	5,360	20,000
Madras	Government cordite factory	1,350	1,350
Mysore	Cauvery Falls	22,650	32,000
Northwest Frontier Province	Malakhand	330	....
Patiala	Patiala	285	430
Punjab	Amritsar	270	700
Do	New Edgerton woolen mills	900	....
Do	Simla municipality	1,680	2,000
Travancore	Pulivasal	530	....
United Provinces	Ganges head works	600	3,000
Do	Mussoorie-Delvia	2,400	2,400

There were three additional enterprises of importance under construction.

The Andhara Valley Power Supply Co. (Ltd.) (associated with the Tata Hydroelectric Supply Co. (Ltd.) project was credited with the installation of 68,000 estimated horsepower, and plans for an ultimate capacity of 90,000 estimated horsepower. A certain American manufacturer has supplied six 15,000-horsepower water wheels for this plant.

The Burma Mines (Ltd.) were installing 9,750 horsepower out of an ultimate capacity of 13,400 horsepower. Burn & Co. were at work on a large undertaking at Laglap-yá in Sikkim, regarding which details were not available.

In the neighboring countries, Afghanistan and Nepal, there are two more water-power plants.

A very large percentage of the generating and other machinery in the above plants is of American manufacture, and the superiority of American equipment of this sort, in its hydraulic, electrical, and transmission aspects, is recognized.

In order to secure adequate data regarding the possibilities of further hydroelectric development the Government has arranged

[13] "Report of Indian Industrial Commission," 1916–1918, p. 74.

for a hydroelectric survey, and in its report submitted in May, 1919, it indicated that, including plants already installed and places under consideration, there were, all told, more than 130 actual sites to which attention has been drawn involving a total of about 1,774,000 horsepower actually in sight. "The total is of course vastly below the actual available power which the final results of the survey will disclose." There are vast possibilities in the way of hydroelectric development that the survey had not been able to include at the time the above report was prepared.

One interesting side light included in the first report of the above survey was a rough census of the power of all kinds actually being used in India in 1919; in a number of items a certain amount of approximation has been necessary, notwithstanding which the following table is of interest:

Provinces.	Brake horsepower.	Provinces.	Brake horsepower.
Assam	22,550	Central Provinces	32,773
Bengal (exclusive of Calcutta area)	25,318	Madras Presidency	39,568
Calcutta area	176,200	Northwest Frontier Province	(1)
Bihar (exclusive of coal mines, etc.)	2,325	Punjab (steam only)	15,734
Bombay Presidency	82,872	United Provinces	38,548
Bombay City (estimated)	750,000		
Burma (exclusive of rice mills, sawmills, etc)	17,750	Total	1,153,638

[1] Undetermined.

It should be added that the Tata interests are actually constructing a third water-power plant to supply Bombay at Nillamulla, which in 1919 was thought to be suitable for a total capacity of 75,000 horsepower. Owing to disturbed conditions in the money and material markets it was understood that the machinery for this plant had not been ordered up to 1922. They also have made surveys for a plant to develop about 300,000 horsepower in the Koyna Valley about 115 miles south of Bombay city, which would involve a considerably longer transmission line. Machinery for this will probably be purchased in 1923. Also, it would appear that with their other plants the Tata interests can furnish Bombay with 232,000 horsepower and presumably would have difficulty in selling this additional 300,000 horsepower there. It has therefore been planned to use this power for manufacturing aluminum, calcium carbide, ferroalloys, caustic soda, abrasives, etc., and probably this would involve the building of a new city and the development of a new port, probably somewhere on the Jaigarh Peninsula. This project will possibly cost about $20,000,000, which with other developments would run the cost up to $80,000,000 or more. The project has been advanced to the point where the Tata interests have secured a three-year option on the site, but as the market conditions have not been suitable for the launching of such a project recently it is probable that it will be carried along some little time further before actual development. The project is in strong hands and may be expected to materialize.[14]

[14] For details regarding the electrical characteristics and the equipment of these plants, see report on "Electrical Goods in British India and Ceylon," by R. A. Lundquist, Special Agents Series No. 213.

SUGAR.

PROBLEMS OF PRODUCTION.

Sugar production in India is a very serious and complex problem, and this, like the water-power problem, illustrates the way in which the Government is devoting its energies to the development of the country—a method that is being applied to other problems also. The following account suggests the development to be expected in other directions.

India was probably the original home of sugar cane and has a larger acreage under this crop than any other country in the world, having on the average, for the nine years ended 1919, devoted 2,718,000 acres to cane. But the yield of sugar per acre devoted to cane has been very unsatisfactory, as shown in the following comparative statement:

	Long tons per acre.		Long tons per acre.
Hawaii	4.91	British Guiana	1.46
Java	3.84	Egypt	1.36
Australia	2.43	Trinidad and Tobago	1.23
Peru	2.23	Louisiana	1.17
Cuba	2.19	Barbados	1.11
Fiji Islands	2.04	Argentina	1.03
Porto Rico	2.02	India	.905
Spain	1.54	Philippines	.86
Mauritius	1.53	Japan and Formosa	.84

Because of the fact that the large population of India has a considerable appetite for sugar, even though the per capita consumption is low, the demand is enormous and the production is inadequate, with the result that India regularly imports a large amount, although there was a time when India exported sugar. The amount of the imports during the four pre-war years 1910–1914 averaged 723,915 tons, valued at 127,100,000 rupees, and during the four war years 1914–1918 averaged 531,713 tons, valued at 134,800,000 rupees, the high price evidently restricting demand unless this decrease may also represent the work of the food controllers. It is very evident that the economic condition of India would be very greatly improved if it were possible to improve production so as to eliminate imports or possibly develop exports, and this would probably involve a 35 per cent increase or a yield per acre a little above that secured in Louisiana, though still far below that of the other leading sugar-producing countries of the world. In view of the climatic advantages of India and the abundant labor, it would seem to be perfectly possible to do this. The agricultural and manufacturing methods used in India are very primitive, and it would seem that India could easily be made self-supporting in this respect. For example, "from cane with the same sugar content factories in Java recover 9.75 per cent of marketable sugar against an average of 6.85 per cent in Indian factories." In other words, if all Indian cane could be handled in mills equal to the standards followed in Java it would be possible to eliminate the importation of 125,000,000 rupees' worth of sugar per year.

As a consequence, the Government of India appointed the Sugar Committee in October, 1919, to investigate and report upon problems connected with the production of sugar in India. This committee has spent nearly a year in travel, visiting every Province, including

nearly a month in Java—all of which involved traveling more than 38,000 miles. The members have studied the problem from all angles and presented a report of about 500 pages. They plan to do as much as possible for sugar in India and offer specific suggestions regarding improved agricultural methods, Government assistance, educational facilities, and improved manufacture. As indicated above, industry should develop rapidly in India if supported strongly by the Government, as indicated here.

SUGAR MANUFACTURE IN INDIA.

The Sugar Committee found 22 factories in India or, if refineries are included, 33 (in Java there are nearly 200 large, modern plants). The report does not indicate the capacity of these Indian plants, but it is stated that no mill has more than 11 rollers (a crusher and three 3-roller mills) while one factory had only a crusher and one 3-roller mill. Most of the factories have a crusher and two 3-roller mills. The plants seem to represent poor engineering and design and, despite the fact that the cane carries 16 to 18 per cent of fiber, purchase a great deal of supplementary fuel. Only one factory in India avoids this; one purchased a weight of only 0.67 per cent of the cane crushed, another 2.3 per cent, a third 3.3 per cent. The average for the remaining factories was 4.31 per cent on the cane crushed or 63 per cent on the sugar produced. Of the fuel so consumed, 48 per cent was wood and 52 per cent coal.

The following excerpt is from the "Report of the Indian Sugar Committee," 1920, pages 324 to 327:

> As a rule, the factories in India are well equipped with machinery for making sugar, but the arrangement is frequently faulty. In many plants the machinery is not well balanced. One part of it has a greater capacity than another, which results in low efficiency and diminished output. * * * An efficient factory should produce not more than 2.5 to 3 per cent of molasses from cane as compared with 9.5 per cent of sugar. Most Indian factories turn out a much higher percentage of molasses than this. According to the returns we have received, only one produced less than 3 parts of molasses per 100 parts of cane; five produced between 3 and 4 parts, six between 4 and 5 parts, and six more than 5 parts. We saw evidence of excessive acidity and fermentation in some of the factories we visited, resulting from undue inversion.
>
> Although, as a result of the absence of mechanical appliances for dealing with cane and juice, the disparity between the number of hands employed in Indian factories and in other parts of the world is especially marked in the milling department, it is also very noticeable in other branches of the factory operations. The returns that we have examined on this point show that only one factory employs, on an average, less than one hand for each 100 tons of cane dealt with during the season. The majority employ from one to three hands to each 100 tons of cane, though in a few cases the proportion is much higher than this. The modern factory in St. Kitts in the West Indies employs less than one hand to every 200 tons of cane worked up during the season. It employs only a little more than 400 hands to deal with 1,000 tons of cane a day, whilst some Indian factories employ as many hands or more to crush no more than from one-fourth to one-half of that amount. Even allowing for the comparative inefficiency and also the cheapness of Indian labor it will therefore be seen that there is considerable scope for reduction of labor costs in India by the introduction of labor-saving appliances and also by more systematic control.

This makes it obvious that most of the cane produced in India is crushed in small mills, for the 22 plants mentioned above would scarcely be considered "factories" in any other of the important sugar-producing countries. Practically all of India's cane is, and long has been, crushed in mills of very small individual capacity.

Up to about 50 years ago the work was done in a charki, a bullock-driven mill operating on the principle of a mortar and pestle. This type is still found in some of the countries of Asia operating on vegetable oils if not on sugar, and surprising claims are made for its effectiveness. However, it is now rarely used on sugar in India. having been supplanted by a roller mill using wooden rollers. This type of mill is still found in some remote parts of the country, but has been largely superseded by mills with iron rollers, and these are now used all but universally all over the great cane-growing sections of India. The most common form is the 3-roller mill, although the less efficient 2-roller mill is still fairly common in some sections.

The report quoted above says, on pages 276, 277, and 280:

Experiments carried out on Government farms have shown that a high extraction of juice can be obtained by the best type of 3-roller mill when it is working properly. Indeed it is doubtful whether any type of mill could be evolved which would give a higher extraction of juice from a single crushing. But it is obvious that the better the extraction from a mill worked by bullock power the heavier the strain on the bullocks. All the witnesses before us who had practical experience of the crushing of the cane crop by bullock mills laid great stress on this point and were agreed that the deterioration of the cattle in consequence of the heavy demands presented a serious obstacle to the introduction of better methods of cultivation. There can be no doubt that, if this deterioration could be expressed in terms of money, the figure would be a very high one.

To show what can be done under the best conditions—that is, when a 3-roller mill in proper order is worked by cattle of good quality—we give the following results which were obtained in the United Provinces from the medium indigenous cane known as "Dikchan":

Type of mill.	Maunds [1] of cane crushed per hour.	Maunds of juice expressed per 100 maunds of cane.	Maunds of juice expressed per 100 maunds of juice in cane.
3-roller iron bullock mill with 8-inch rollers	2.53	66.8	80.5
3-roller iron bullock mill with 6-inch rollers	1.83	59.7	74.7

[1] There are many kinds of "maunds," but in this instance the maund equals 82¾ pounds.

Such high efficiency as this can not, however, be obtained for any length of time by cultivators with their light and often underfed cattle. Our examination of the megasse from numerous village mills made only too evident the loss of efficiency which results from the loosening of the mill in order to reduce the strain on the cattle and so to enable them to get through the crop. * * * We estimate that, over India as a whole, the cultivator obtains on an average not more than 55 parts of juice per 100 of cane. * * *

It has, we think, been made clear in the preceding paragraphs that the development of the gur industry must proceed on two main lines. The first is the introduction of power crushing on a relatively small scale by mills of better design than the present 3-roller mill. Such mills would be driven either by oil or steam, and we consider that the most convenient unit would be a mill crushing 1 or 2 tons of cane an hour. * * *

There is, in our view, no agricultural operation to which power-driven machinery can be more effectively applied than for crushing cane. If increased outturns are to be secured, it is above all essential that improved methods of cultivation should be adopted. They can only be adopted to the extent that the number of cattle available and their condition permit. * * * One of the most pressing problems in Indian agriculture would be in a fair way toward solution if the bullocks could be relieved of two of the agricultural operations which make the heaviest demands on their strength—the crushing of cane and the threshing of the "rabi" crop. They are both operations which can be carried out by power-driven machinery; and, in our opinion, the successful

introduction of such machinery presents fewer difficulties than do most changes in the agricultural practice in India.

Following the above paragraphs the report points out the difficulties that have been experienced in earning profits with the experimental plants that have been used. These very small mills are necessary largely because the system of land tenure seems to make it impractical for a large mill to secure adequate supplies of cane. On the whole, it would appear that India may be expected to install a few large plants in certain sections of Assam and Burma where the necessary land can be secured, but for the large existing acreage advancement will probably be in the direction of improvements upon the present bullock-driven mills and the boiling equipment used therewith.

Among the improvements suggested is the addition of an extra pair of splitting rolls to the 3-roller mill, making it into a 5-roller mill, and the development of special designs on these lines—one for a capacity of 1 ton of cane per hour (requiring probably 6 brake horsepower to drive) and one for a capacity of 2 tons of cane per hour. The Industrial Commission pointed out that by improving the extraction 10 per cent by methods such as the above and by increasing the yield of cane 20 per cent by the use of fertilizer and better cultivation India could be made self-supporting. All of this seems perfectly feasible, but will involve the use of possibly 200,000,000 rupees' worth of oil engines.

In this connection it is interesting to add that it has been proposed to establish a corporation to manufacture in India the machinery needed for the sugar industry there, placing the works near the Tata steel plant in order to secure a favorable supply of raw materials. It has been suggested that this company be capitalized at 50,000,000 rupees (about $16,000,000) and arrange for technical guidance and cooperation with qualified sugar experts in Great Britain or the United States.

KINDS OF INDUSTRIAL DEVELOPMENT ANTICIPATED.

In the above discussion the methods followed in stimulating development in connection with hydroelectric projects and the sugar industry have been treated with a good deal of detail in order to illustrate the policies and methods employed and to show why India may be expected to develop. These problems are being approached with splendid spirit, and in India, at least, it is felt that the country will come to take its place as one of the important manufacturing countries of the world. The list of opportunities under consideration is a long one, as suggested by this incomplete list:

Structural-steel fabricating.
Machine-tool manufacture.
Textile-machinery manufacture.
Tea-machinery manufacture.
Tea-lead manufacture.
Railway-car building.
Locomotive building.
Mining machinery.
Steel pipes and tubes.
Galvanized sheets and other articles.
Rivets, bolts, and nuts.
Enameled ironware.
Tin plate.
Fire brick and silica brick.
Sulphuric, nitric, and hydrochloric acid, ammonia, caustic soda.
Dyes.
Fertilizers.
Leather and tanning materials.
Shoes and harness.
Portland cement.
Paints.
Varnishes.
Soap.
Paper manufacture.
Glass production.

The list might be extended much further. Clearly India has started on an extensive program of industrialization, and considerable progress has been made. The production of cotton goods, iron, steel, etc., has been shown, but that list is far from complete. In addition, there are many other large industries. There is lumbering in Burma; Indian cement plants now produce more than 75,000 tons annually; 57 soap factories produce more than 23,000 tons of soap each year; half a dozen paper mills produce about 13,000 tons per annum, etc. The Government is encouraging development, and it seems certain that important expansion is at hand.

AMERICAN INTEREST IN MACHINERY TRADE OF INDIA.

The volume of the machinery imports of India and the volume of American exports to India are shown on page 83, and it may be noted that the American share expanded from about $540,000 in 1914 to about $16,850,000 in 1921, and the participation rose from 1.8 per cent to 16.5 per cent. The participation of others in this trade is shown more fully in the table below. These data are taken from the customs returns as published by the Government of India and are very dependable, but they make the position of the United States appear a little worse than the facts justify, because transshipment cargo is credited to the last port of shipment, and American machinery shipped via London, for example, is credited to the United Kingdom. It seems that important quantities of this equipment are so handled.

TOTAL VALUE OF MACHINERY AND MILLWORK IMPORTS INTO INDIA.[1]

Countries of origin.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
United Kingdom.	£5,596,301	£3,616,889	£2,945,995	£1,861,119	£2,192,504	£5,840,545	£16,780,199
Other British territories.........	25,031	16,810	16,598	26,709	31,295	47,680	80,373
Total British Empire.....	5,621,332	3,633,699	2,962,593	1,887,828	2,223,799	5,888,225	16,860,572
Sweden...........	214	1,245	4,339	12,598	13,018	53,688	174,915
Germany.........	287,643	2,199	390	....	....	....	147,810
Belgium..........	12,384	627	....	....	....	80	73,755
Switzerland......	17	11,813	9,848	22,853	34,780	58,608	27,491
Italy.............	4,013	24,461	19,242	13,645	13,586	21,301	21,902
Austria-Hungary.	12,564	....	....	....	....	....	....
Japan............	10,423	51,673	88,625	133,411	164,788	60,900	118,957
United States.....	112,170	152,075	206,373	490,590	798,198	2,531,968	3,463,640
Others............	15,846	4,514	6,170	18,367	10,071	38,109	114,960
Total.........	6,076,606	3,882,306	3,297,580	2,579,292	3,258,240	8,652,879	21,004,032

PERCENTAGES FROM TWO PRINCIPAL COUNTRIES.

United Kingdom.	92.1	93.0	89.5	72.3	67.4	67.5	79.9
United States.....	1.8	3.9	6.2	19.0	24.5	29.3	16.5

[1] These figures exclude sewing machines, typewriters, agricultural machinery, and machinery for Government railways and other departments. The pound was worth approximately $4.86 in 1914, but in 1915 to 1917 it stood at about $4.76, while in 1919, 1920, and 1921 it fluctuated a great deal and at times fell below $3.50. Although these returns are given in pounds they are originally collected as rupees, the conversion being made into pounds at an arbitrary rate which at times differed materially from the current bank rates, particularly in 1919.

Clearly American machinery manufacturers have a very important interest in this market, and the tendency toward industrial expansion described in the preceding pages of this report indicates

that the value of this trade to Americans should grow rapidly during the coming years. Obviously Great Britain has been able to secure a greater proportion of this trade than the quality, price, or engineering merit of its products would justify. It is very doubtful whether the British ratios for the earlier years could be equaled in any of the other markets of the world. It is worth noting that in India, one of the largest of colonial machinery purchasers, the German participation was less than 5 per cent.

It would appear that Americans are in a position to be of particular service in solving the engineering problems of India. This has already been shown in the work of American specialists in connection with the steel, water power, petroleum, automotive, and other engineering problems there. Also, one would conclude that Americans are especially well fitted to solve many of the other problems still unsolved there, such as the establishment of a cottonseed-oil industry or problems connected with the sugar industry and railway transportation. In fact, American engineering would demonstrate its superiority in most lines.

It would seem that the present balance of trade would justify Americans in expecting a larger share of the Indian import trade, as in some recent years we have purchased from India more than six times as much as it has purchased from us; in the last eight years our excess of imports has totaled more than $485,000,000. Having purchased so liberally in the past, we have a certain claim for corresponding consideration for American products. The particulars are shown in the following table of American-Indian trade:

Years.	Imports to United States from India.	Exports from United States to India.	Excess of imports.
1914	$63,083,948	$10,378,806	$52,705,142
1915	59,309,076	15,709,580	43,599,496
1916	86,656,980	23,891,754	62,765,226
1917	101,057,067	33,599,396	67,457,671
1918	129,688,009	40,392,458	89,295,551
1919	140,081,000	67,505,528	72,575,472
1920	176,073,650	99,827,517	76,246,133
1921	78,188,776	56,769,898	21,418,878

In this connection it may be added that throughout this entire period more than 85 per cent of the imports from India were admitted to the United States free of all duty.

The Pittman Act similarly justifies us in expecting consideration at the hands of Indian purchasers.

But the factor of greatest interest to Americans is that the markets of India have been absorbing from $12,000,000 to $30,000,000 worth of industrial machinery per year for a good many years and give promise of absorbing much larger quantities. To a large extent these markets have been neglected—very badly neglected. American machinery manufacturers should arrange for more adequate representation and better salesmanship in India.

CONDITIONS AFFECTING DISTRIBUTION.

In all of the foregoing discussion the machinery market of India has been considered as a whole, and to a great extent this is neces-

sary, because the customs returns in many instances are not subdivided, but in reality India contains five distinct markets, which are a long distance apart and differ greatly in many respects. Bombay is 1,223 miles from Calcutta by railway, and the best trains require 46 hours for the trip—a distance that compares with that between New York and Kansas City in distance but between New York and Denver as to time. Obviously a man selling steam engines in Denver could have but little influence on engine sales in New York, and the situation as between Calcutta and Bombay is similar. Correspondingly, Madras is 1,032 miles, or 42 hours, from Calcutta—a distance that compares with that from New York to St. Louis and in time with that between New York and points in western Nebraska. From Madras to Bombay is 794 miles and 36 hours, comparing with the distance from New York to Indianapolis in miles or from New York to Omaha in time. From Madras to Colombo is also a rail journey of about 36 hours, but owing to delays the rail journey from Calcutta to Colombo is 88 hours—3 days 16 hours—corresponding roughly to the trip from New York to the Grand Canyon or Salt Lake City. Rangoon and Burma are separated from India by mountains that, as yet, have prevented the railways from opening a through connection, so that one goes from Calcutta to Rangoon by steamer, a distance of 776 miles, corresponding to that between New York and Charleston, S. C., in about three days, or one day less than from New York to Key West. From Rangoon to Colombo is 1,256 miles, much the same as the distance from Calcutta to Colombo. From Rangoon to Singapore is 1,164 miles, corresponding to the distance from New York to Habana. These distances, together with the comparative map published at the beginning of this section, will perhaps convey an impression of the size of this territory and the sales problems involved. As a territory Burma extends about 1,200 miles from north to south, a distance similar to that from New York to St. Louis, and Rangoon is the market for all of it. The fifth market of India is Karachi, a city on the seashore but in a desert—a city where it seldom rains and where the climate is particularly favorable. Karachi has railway connection with points on the Baluchistan frontier and supplies the more productive districts in the Punjab. In a sense it is also the port through which to reach Kashmir, Peshawar, and the whole northwest. This is the territory it serves, for the Sind Desert lies between Karachi and India proper, and to travel by rail from Bombay involves a circuitous, dirty, and unpleasant trip of 992 miles in about 48 hours. As a consequence one usually travels more directly by boat in about 40 hours. Unfortunately there are usually only two boats per week.

The territory served from each of these cities is more or less obvious. Rangoon supplies the territory reached by the railways and other transportation facilities of Burma. Calcutta supplies the Brahmaputra Valley and the Ganges Valley up to perhaps Delhi; it also extends its influence down the eastern shore of the peninsula. Madras serves the central part of the peninsula, competing with Calcutta on the north, Colombo on the south, and Bombay on the west. Bombay supplies the western part of the peninsula, and its influence is felt over toward Madras and up toward Delhi and Lahore. Karachi extends its influence up the railway and through

the Punjab, supplying the northwestern part of the country and exerting an influence toward Lahore and possibly beyond, toward Delhi.

Distances are great in this part of the world, where life is often somewhat primitive. From Penang to Madras or Calcutta or Rangoon is a longer voyage in time than from New York to Liverpool or from New York to Galveston.

These matters are emphasized in this way because experience shows that the impressions gained from small maps published by steamship companies or in atlases and school geographies are deceptive; moreover, the distances are more serious in Asia because the railways and steamships operate more slowly and less frequently. But from what has just been noted it is obvious that a manufacturer can not expect a representative situated only in Calcutta to have any influence whatever on business in Burma, Madras, Bombay, or beyond, and a merchant asking for an agency agreement covering all of India should be asked to demonstrate his ability to furnish adequate representation in all of these markets. In fact, he should also be able to cover Colombo, as parts of southern India are reached from there.

These different markets should also be studied with regard to their differing demands. It has already been pointed out that, ordinarily, cotton-mill machinery will be used in Bombay, and jute-mill machinery in Calcutta. Similarly, coal-mining equipment will go to Calcutta and sawmill, rice-mill, and oil-well equipment will go to Rangoon. There are many distinctions of this sort. As there are so many different kinds of industrial machinery, and as each has its own peculiar market problems, it is not practical to discuss each in detail in this report. Also, to a large extent, it is necessary to rely upon the customs returns for the information required, and these are seldom satisfactorily complete. Furthermore, the classifications differ from one country to another, making comparison very difficult. For this reason it has seemed necessary to be content with merely publishing at the end of this chapter the customs returns covering the machinery classifications as issued by the Governments of India, Great Britain, Japan, and the United States. It is felt that with these data any manufacturer can make a complete statistical survey regarding the market for his products in India, so far as the data available make this possible. The returns herewith presented are the most recent available at the time this report is published. An effort has been made to have this statement complete and up to date.

It should be explained, with regard to these returns, that where shipments are credited to Bengal it practically means Calcutta, for the amount of machinery shipped through the smaller ports is comparatively of little importance, and even if shipments were made to, say, Chittagong, the market is still Calcutta, for that is where the dealers all have their offices. Similarly, the returns for Bombay technically include imports into some of the smaller cities in the Bombay presidency, but practically all of the machinery goes to the city of Bombay, and that is where the dealers are. Most of the shipments for Madras pass through the city of Madras. These districts are all densely populated and supply large areas. The returns for Sind refer almost entirely to imports at Karachi, which,

as has been stated, lies in a desert, and the machinery is then sent several hundred miles upcountry over a dusty railway, where the summer temperatures often exceed 110° F. Most of this equipment is distributed in the Punjab. Imports into Burma practically all go to Rangoon, although there are a number of other harbors along the coast. These goods are distributed northward by rail and southward by coasting vessels.

In making a study based on these tables it should be remembered that Bombay and Karachi served as bases for the military operations in Mesopotamia and Persia and those against the Afghans and frontier tribes, and that this fact influenced private as well as Government purchases in a very marked degree. Also these returns are a definite record of the past, but do not measure the future very satisfactorily. India is progressing very rapidly, and in previous pages an effort has been made to show what sort of development is to be expected. In planning a sales campaign in these markets allowance should be made for orders placed in the United Kingdom. The mines, private railways, and other large companies often buy in London, although there is a tendency to place more and more business in India. With these thoughts in mind it is hoped that it will be possible to estimate the value of each of these markets with reasonable accuracy.

STEAM-BOILER LAWS.

There is a great deal in the engineering now found in India that probably would not meet the approval of American engineers, although it does represent British practice. For example, rope drives are far more common than in the United States. Corliss engines are commonly equipped with direct-connected feed, circulating, and air pumps, according to circumstances, and frequently the flywheels are provided with barring engines. In other ways and with other classes of machinery the designs, equipment, and methods are British, but most of these matters are purely questions of convenience. But there are matters in connection with which it is necessary to meet the local requirements, as in electrical installations, where it is necessary to pass the local inspection, which is very commonly based on British frequencies and voltages as distinguished from the corresponding American standards. There is a tendency in the direction of demanding that important installations conform to the British standard. However, electrical development has not yet progressed very far in India, and, apart from a few large water-power plants, there are no important transmission lines. Installations to date represent an assortment of isolated plants or small municipal plants of a great variety of electrical characteristics. The Calcutta Electric Supply Corporation still furnishes direct current throughout the municipality.

But in connection with steam boilers it is necessary to comply with the local laws governing their manufacture, installation, and operation, and each Province has its own particular set of rules, which differ from each other and from the codes used in Europe. The Department of Commerce, Washington, has on file the rules for most of these territories, but some are now out of print. Also a committee is preparing a new code that is planned to cover all of

India and supersede the several existing provincial codes. It is not yet possible to say when this code will be ready or what it will contain, but it seems safe to say that it will have the early attention of the authorities.

In general the old codes of the various Provinces follow the British rules. They require a weighted type of safety valve on all stationary types of boilers, which is unfortunate, as the operatives tie bricks on the weights or wire the lever so as to hold the valve on the seat. The spring-loaded valve properly locked and sealed in place seems a far better design, but can not be used, as it is not approved. Meanwhile explosions continue. Similarly, the quadruple-riveted joint is not yet recognized and should not be used on boilers for India. The writer encountered instances where important installations were required to reduce the working pressure 15 pounds for this reason. There are many other details that should be watched in order to be sure that the boiler laws are not violated.

IMPORT DUTIES.

The paragraphs of the British Indian customs tariff applying to machinery are quoted below in full. In a general way, the situation may be summed up by the following statement: Machinery generally pays 2½ per cent, railway plant and rolling stock 10 per cent, and machinery not power driven 15 per cent.

MACHINERY (2½ PER CENT DUTY).

No. 81. Machinery, namely, prime movers and component parts thereof, including boilers and component parts thereof; also including locomotives and portable engines, steam rollers, fire engines, motor trucks designed for purposes other than agriculture, and other machines in which the prime mover is not separable from the operative parts.

Machinery (and component parts thereof), meaning machines or sets of machines to be worked by electric, steam, water, fire, or other power not being manual or animal labor, or which, before being brought into use, require to be fixed with reference to other moving parts; and including belting of all materials for driving machinery.

Provided that the term does not include tools and implements to be worked by manual or animal labor, and provided also that only such articles shall be admitted as component parts of machinery as are indispensable for the working of the machinery and are, owing to their shape or to other special quality, not adapted for any other purpose.

NOTE.—This entry includes machinery and component parts thereof made of substances other than metal.

RAILWAY PLANT AND ROLLING STOCK (10 PER CENT DUTY).

No. 95. Railway material for permanent way and rolling stock, namely, cylinders, girders, and other material for bridges, rails, sleepers, bearings and fish plates, fishbolts, chairs, spikes, crossings, sleeper fastenings, switches, interlocking apparatus, brake gear, couplings and springs, signals, turntables, weighbridges, engines, tenders, carriages, wagons, traversers, trolleys, trucks, and component parts thereof; also the following articles when imported by or under the orders of a railway company, namely, cranes, water cranes, water tanks, and standards, wire, and other materials for fencing.

Provided that for the purpose of this entry "railway" means a line of railway subject to the provisions of the Indian Railways Act, 1890, and includes a railway constructed in a State in India and also such tramways as the Governor General in Council may, by notification in the Gazette of India, specifically include therein.

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Provided also that only such articles shall be admitted as component parts of railway material as are indispensable for the working of railways and are, owing to their shape or to other special quality, not adapted for any other purpose.

MACHINERY (15 PER CENT DUTY).

No. 82. Machinery and component parts thereof, meaning machines or parts of machines to be worked by manual or animal labor, not otherwise specified.

No. 118. Packing—engine and boiler—all sorts, excluding packing forming component part of any article included in Nos. 81 and 95.

There has been a marked tendency in British India toward advance of the import duties on all articles, including machinery. Thus far (1922) there has been no discrimination in favor of British machinery, although the subject of imperial preference has been actively discussed for some years and has been the subject of special inquiry by the Indian Fiscal Commission. Serious discrimination along these lines is not anticipated; Americans will find it rather in the operations of the India Office in connection with Government purchases and in the attitude of the British toward alien sellers.

SIZE AND WEIGHT OF PACKAGES.

In the earlier section of this report attention has been called to the need of keeping the size and weight of the packages in a consignment within reasonable limits, and especial attention has been drawn to the difficulties met in landing heavy cargo at Calcutta. Conditions in the other cities are worse rather than better. The mere delivery of a heavy or bulky package becomes very expensive. If transshipment is involved this expense multiplies very rapidly, as shown by the lift scales mentioned in those pages.

If a package is to be delivered over one of the railways, this subject needs further consideration, as the railways in India are built on four different gauges and the maximum size of package that can be handled varies correspondingly as shown in the following table of maximum sizes:

Items.	Gauge.		
	5 feet 6 inches.	1 meter.	2 feet 6 inches.
	Ft. in.	*Ft. in.*	*Ft. in.*
Width	10 8	8 8	7 8
Height	7 3	7 6	7 ½
Length (estimate)	19	....	....
	Tons.	*Tons.*	*Tons.*
Weight (estimate)	19	14	10

The matter of length is dependent upon a variety of factors. There are special cars that can carry unusual weights, but generally speaking it will be found that complications will develop whenever the above limits are exceeded. Unfortunately, corresponding data applying to the 2-foot railways are not available.

In cases where it is necessary to rely upon other methods than the railways for the delivery of machinery, it is very much more desirable that the weights be limited as much as possible. On the

roads it is necessary to rely upon bullock carts and laborers and carts. Animals and men are all deficient in strength, and the roads are often poor. When delivery can be made by water the boats are often light and weak, and there is a good deal of risk involved in landing such packages from these small craft at points where the facilities are poor.

REPRESENTATION.

In each of the principal machinery markets of India, namely, Calcutta, Bombay, Madras, Rangoon, and Karachi, there are importing firms that act as machinery dealers. In some instances these firms are native, and in others they are European. In Calcutta and Bombay some of these firms are large and strong and employ competent engineers on their staffs. But American manufacturers will probably find it difficult to obtain satisfactory representatives unless they succeed in concluding arrangements with one of the very few American companies established there. It will be found that the native and European firms, even if they employ trained engineers, have no adequate appreciation of American mechanical equipment or the ways in which it should be used. American manufacturers will find that their representatives in India should be of the highest possible standard, and whenever practicable manufacturers should maintain a competent employee in the territory.

When it becomes necessary to rely upon the existing importing firms and their present organization, manufacturers can secure a great deal of information from the files of the Department of Commerce in Washington, where a rather complete collection of data may be examined, though it is scarcely practicable to distribute this information by mail. Some of these firms are large, others are small, many are old and well established. Each has its own particular bent, and care should be exercised in appointing agents in order to secure the most effective representation possible in each district and to establish proper boundaries for the district. Whenever no better method is available, the Department of Commerce is prepared to send lists of dealers by mail, but this method has somewhat narrow limitations.

Whenever circumstances allow, the best results will probably be secured through the American firms. In other cases probably one should try to arrange to have an employee taken into the territory by the agent. When such a man is sent to India he should be of a decidedly superior type. His most important qualification should be that he has the implicit confidence of the manufacturer, so that all concerned will be assured that full reliance will be placed upon his reports. He must have a personality that will assure his continuance as persona grata with the British and Indian community with which he will live. He must be fully qualified and have a thorough knowledge of the machinery he is to offer and its uses, and, so far as possible, should be familiar with competitive material from European sources and the ways in which it is employed. It is also desirable that he be well posted on general engineering subjects and able to controvert detractors of American products. The best man available will find the situation a real test of his abilities, and probably the opportunities will appeal to his ambitions.

Generally speaking, the importing firms will be found to have good financial standing and no difficulty will be experienced on the score of credits or terms of payment if the usual care is taken and the usual arrangements made.

ADVERTISING.

It has been pointed out elsewhere that India has more than 200 different languages and overwhelming illiteracy. The result is that English is the language of commerce, and ordinarily those interested in factory machinery will have an adequate knowledge of English. On the other hand there are very few competent engineers in India, and most Americans would be disappointed in their engineering accomplishments. For these reasons newspaper advertising will prove of more value than elsewhere if a well-conceived campaign is pursued. Probably the composition of these advertisements should be left to some one in India, familiar with conditions there. In addition to the newspapers there are a number of commercial, industrial, and trade periodicals that can be employed.

Agents in the country should be equipped with a liberal supply of catalogues, but it was noticed by the writer that literature mailed in from abroad is largely wasted.

MERCHANDISE MARKS ACT.

Goods having a counterfeit trade-mark are not admitted to India. The amplification and interpretation of this idea sometimes leads to embarrassment and fines for persons handling American machinery, for it is held that commodities marked with words in the English language will be presumed to have come from the United Kingdom unless there is a clear mark indicating some other origin. As practically all American machinery bears some mark in the English language it will also require a mark indicating the country of origin. While this mark may have a variety of forms it will probably be best to use the expression "Made in U. S. A." "Made in Boston" would not suffice, as there is a Boston in England. The act also provides that every application of the name or trade-mark must be accompanied by a definite indication that the goods have been made beyond the limits of the United Kingdom and British India, and this indication is to be in letters as large and conspicuous as any letter in the name or trade-mark.

This rule is often very disconcerting. For instance, watermarked paper made in the United States must have the watermark also show "Made in U. S. A." in large letters on each sheet marked if it is to be shipped to India. This may introduce complications if, in cutting, the watermark is not entirely on the sheet. Another rather difficult article is a spark plug. As ordinarily manufactured these often bear such a mark as "Pat. 41144." The article is so small as to make further marking awkward. But as the above is evidently from the English language and as the article was made outside of India and the United Kingdom, it is necessary to indicate the country of origin, and unless it is also marked "Made in U. S. A." there is a strong probability that it will be confiscated or the importer fined. An outboard bearing pedestal for a steam engine or other unit arrives at the customs as a separate package and may bear the maker's brand or trade

name. Unless it also indicates "Made in U. S. A." in letters of approved size the importer may be fined, even though this indication of origin may be on the base casting and the two would be very closely associated on the assembled unit.

The matter has become so much involved that the Government of India has issued a "Merchandise Marks Manual" covering the whole subject, a copy of which is on file in the division of foreign tariffs, Department of Commerce, Washington, D. C.

The table below shows the number of instances in which goods have been detained by the officials under the authority of the above act. The first column may be considered a measure of the dishonesty detected and indicates how important it is to take advantage of the trade-mark registration offered, inadequate though it may be. The second column, in a sense, measures the instances where importers are annoyed because of carelessness on the part of a shipper. The "Total" column under "Number of detentions" indicates that the act is enforced rigorously and suggests that importers are annoyed needlessly in many instances and thereby emphasizes the reality of the need for being punctilious about observing these rules.

Years.	Number of detentions.				Cases where detention was followed—		
	Counterfeit trade-marks or false trade descriptions.	Nondescription or false description of origin.	Unstamped or insufficiently stamped piece goods.	Total.	By confiscation.	By release.	
						With fine.	Without fine.
1910-11	680	1,159	304	2,143	6	1,100	1,037
1911-12	506	1,152	246	1,904	2	1,022	880
1912-13	481	1,580	285	2,346	1	1,445	900
1913-14	794	1,622	385	2,801	....	1,634	1,167
1914-15	388	553	258	1,199	....	614	585
1915-16	195	1,705	290	2,190	2	1,045	1,143
1916-17	442	1,668	828	2,938	19	1,776	1,143
1917-18	192	2,071	547	2,810	7	1,649	1,154
1918-19	389	2,213	610	3,212	5	2,061	1,146
1919-20	245	1,953	807	8,005	9	2,050	946

Ceylon also has a similar "merchandise marks act," and it works out in a similar way, but it should be remembered that the governments are independent and one should not be led into confusion by assuming that a ruling in one country applies to the other.

PATENTS, TRADE-MARKS, AND COPYRIGHTS.

Patents can be secured in India. They are issued by the controller of patents and designs, 1 Council House Street, Calcutta, under the Indian patents and designs act (II of 1911) or in continuation of applications under the inventions and designs act (V of 1888). All communications on this subject should be addressed as above. Directions for the guidance of inventors and others are given in the Indian patents and designs act, 1911, and in the Indian patents and designs rules, 1912. Applications submitted to the controller should conform strictly to these rules. The International

Convention for the Protection of Industrial Property does not include India.

Further particulars can be obtained from the division of foreign tariffs, Bureau of Foreign and Domestic Commerce, Washington, D. C.

There is an increasing tendency toward copying and imitation or even clear infringement, and Americans are urged to take the steps necessary to protect their interests.

There is no provision of law in British India for the registration of trade and property marks and names, but it is the practice to register a declaration of ownership under the Indian Registration Act of 1908. This has no legal effect, but affords some evidence, under an official seal, of proprietorship and use.

The requirements of such a declaration are: A power of attorney; declaration; four facsimile copies of the trade-mark; and a small electrotype if advertisement in the Calcutta Exchange Gazette or other newspaper is desired.

In the absence of definite trade-mark legislation protection is limited to protest against fraudulent marking under the provisions of the Merchandise Marks Act of 1887.

The Madras and Upper India Chambers of Commerce now undertake the registration of trade-marks, but it is understood that such registration serves only as evidence of the date of registration and confers no legal right on the registrant. Similar facilities are extended by the Bombay Mill Owners' Association to its members.

Under the Indian Copyright Act of 1911, the operation of British copyright laws is extended to India.

INVESTMENT OPPORTUNITIES.

There are numbers of opportunities in India for the investment of American capital in manufacturing, planting, and other enterprises, and attractive profits could probably be secured. At the time of writing this, there are certain restrictions applying to those who are not British subjects (for example, mine leases can not be granted to aliens), but it is understood that the Government is considering further relaxation of these restrictions.

COINAGE, WEIGHTS, AND MEASURES.

The unit of currency in India is the rupee, which can scarcely be described as either a silver unit, a gold unit, or a token. Originally the rupee contained 165 grains of pure silver and still contains this as minted. Down to about 1873 the gold value of this coin was approximately equal to 50 United States cents, but as the comparison was ordinarily made to English currency it was usually considered to have a value of about 2 shillings, or one-tenth of a pound sterling. Following 1873 silver depreciated throughout the world and there was a serious and continuing fall in exchange. At one time the rupee dropped as low as 12½ cents. This situation resulted in great embarrassment to the Government of India, and it was finally decided in 1893 to close the mints so that there should no longer be a free and unlimited coinage of silver. This was a deliberate attempt to force up the value of the rupee by restricting its circulation, converting it from a silver unit to token money. It was planned to pursue this policy until the exchange value of the rupee should be

1 shilling 4 pence, or approximately 32 American cents, which would "peg" the exchange value of the rupee at one-fifteenth of the pound sterling. From 1899 to 1919 the rupee was in this manner held at the value indicated.

It should be noted that the rupee was "pegged" in value to the pound sterling and not to the British sovereign. When British money depreciated, following the Great War, there was a distinct tendency for the rupee to depreciate correspondingly so long as the British and Indian Governments maintained the above ratio. At this same time the price of silver was very high and the bullion value of the rupee exceeded the monetary value; as a consequence, in 1919 it was no longer possible to maintain the old exchange ratio of 15 rupees to the pound, and the rupee value rose to more than 2 shillings, or 50 American cents.

Unpleasant experiences associated with these fluctuations induced the Government of India to modify the exchange ratio, and it was decided to fix the value of the rupee at "2 shillings gold," thus "pegging" the rupee to the gold sovereign, as distinguished from the paper pound sterling, and giving the rupee a definite value of 48.6 cents. Shortly after this the world's price for silver rapidly decreased, and, the trade balances also being unfavorable, the rupee again fell, reaching a value approximating the old ratio of 15 to 1. At the time of writing (1922) the rupee has a theoretical gold value of 48.6 cents, but an actual value of approximately 30 cents.

India has an individual system for expressing large numbers, and numerical tables are punctuated differently, to correspond. A lakh is 100,000 (written 1,00,000), and a crore is 10,000,000 (written 1,00,00,000). These units are a great convenience and are commonly used in the commercial world in India. Where Americans would say that new flotations during a given month were $20,000,000, a corresponding statement in Calcutta would be that they were two crores of rupees.

Coinage is divided as follows:

1 rupee=16 annas.
1 anna=12 pie.

The weights used in India have a uniform scale, but the units vary greatly in value. Those most commonly used are as follows:

1 maund=40 sers.
1 ser=16 chittaks.
1 chittak=5 tolas.

The weight of a ser varies endlessly, not only from district to district or Province to Province but even from village to village or for different commodities in one village. This lack of a universal system is a distinct handicap on the commerce of the country, and efforts have been made for decades to establish a standard and uniform system. Unfortunately it has been impracticable to overcome the conservatism of the Indian populace, and the ancient methods are still followed. Thus in one of the Provinces alone it is found that a maund of sugar weighs 48½ sers in Cawnpore, 72½ in Gorakpur, 40 in Agra, 50 in Moradabad, 43¼ in Saharanpur, 50 in Bareilly, 46 in Fyzabad, 51 in Goshangunge, etc.

An effort has been made to establish a standard system in which the tola weighs 180 grains troy, which is the exact weight of the

rupee. This would give the ser a weight of 2.057 pounds and the maund 82.28 pounds. These are the values that are used in the official reports published by the Government of India.

Correspondingly, the unit for square measurement in India is the bigha, and this unit also varies greatly in different parts of the country. The only successful way to describe areas is to ascertain the value as expressed in acres or square miles or some other well-recognized unit.

In correspondence with India on business matters one should always remember that a ton will be considered 2,240 pounds and a gallon the imperial gallon as used in England. Where it is necessary to refer to the American ton, gallon, or other unit, it should be indicated with special clearness.

DETAILED STATISTICS OF MACHINERY TRADE.

The following table shows, according to official Indian figures, the imports of machinery into India, excluding sewing machines, typewriters, agricultural machinery, and machinery for Government railways and other departments:

Articles and countries of origin.	1913-14	1915-16	1916-17	1917-18	1918-19	1919-20	1920-21
LOCOMOTIVES.							
United Kingdom	£1,306,553	£1,007,992	£167,637	£72,618	£206,639	£458,721	£4,675,529
Germany	77,281	64	...	...	...	...	...
United States	71	11,378	10,060	13,098	5,101	70,249	149,763
Japan	...	...	...	...	1,287	...	...
Belgium	7,180	...	...	...	...	...	35,525
Others	...	...	...	...	...	...	1,654
Total	1,391,085	1,019,494	177,697	85,716	213,027	528,970	4,862,471
OTHER PRIME MOVERS.							
United Kingdom	512,177	268,317	229,052	109,647	95,879	435,981	1,656,966
Other British territory	699	1,657	1,237	1,654	1,649	1,899	10,752
Total British Empire	512,876	269,974	230,289	111,301	97,528	437,880	1,667,718
Germany	27,598	...	...	...	...	...	13,612
Japan	...	68	793	1,382	1,892	270	144
United States	6,986	14,053	16,831	44,701	41,678	152,192	160,295
Others	6,133	2,878	13,310	13,161	16,440	19,116	76,601
Total	553,593	286,973	261,223	170,545	157,538	609,458	1,918,370
ELECTRIC GENERATORS.							
United Kingdom	20,057	8,448	13,038	4,348	609	189,173	306,489
Other British territory	...	...	...	...	...	292	1,062
Total British Empire	20,057	8,448	13,038	4,348	609	189,465	307,551
Germany	280	...	...	...	...	...	...
Japan	...	...	...	...	...	698	...
United States	213	81	7,557	586	14,690	59,901	231,429
Others	332	6,670	1,695	...	...	2,165	698
Total	20,882	15,199	22,290	4,934	15,299	252,229	539,678
ELECTRIC MOTORS.							
United Kingdom	82,822	50,370	76,689	27,544	24,581	126,100	500,506
Other British territory	118	62	41	260	370	376	170
Total British Empire	82,940	50,432	76,730	27,804	24,951	126,476	500,676
Germany	5,280	...	...	...	...	...	454
Japan	...	...	...	...	246	924	692
United States	2,706	2,044	13,064	17,534	50,585	215,380	96,212
Others	1,631	1,457	802	1,826	1,063	1,093	15,738
Total	92,557	53,933	90,596	47,164	76,845	343,873	613,772

Articles and countries of origin.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
TRANSFORMERS.							
United Kingdom	...	...	...	...	...	£4,239	£12,644
United States	...	...	...	...	...	21,836	29,522
Others	...	...	...	...	...	...	1,261
Total	...	...	...	...	...	26,075	43,427
OTHER ELECTRICAL MACHINERY.							
United Kingdom	£194,923	£128,675	£153,031	£92,192	£108,187	244,434	607,870
Other British territory	359	289	106	505	1,269	2,039	379
Total British Empire	195,282	128,964	153,137	92,697	109,456	246,473	608,249
Germany	29,818	358	...	...	...	...	225
Japan	...	...	12	...	477	762	...
United States	1,783	9,797	17,540	36,944	43,778	355,876	307,459
Others	4,974	11,029	9,494	11,481	14,603	15,393	11,566
Total	231,857	150,148	180,183	141,122	168,314	618,504	927,499
AERATED-WATER-MAKING MACHINERY.							
United Kingdom	5,014	1,637	705	578	1,071	3,793	15,791
Other British territory	68	...	...	...	196	82	...
Total British Empire	5,082	1,637	705	578	1,267	3,875	15,791
Total foreign countries	191	...	3	16	...	44	350
Total	5,273	1,637	708	594	1,267	3,919	16,141
BOILERS.							
United Kingdom	224,999	136,156	117,986	52,047	41,821	342,257	1,545,523
Other British territory	1,272	...	166	2,577	1,650	1,366	279
Total British Empire	226,271	136,156	118,152	54,624	43,471	343,623	1,545,802
Germany	2,679	...	...	...	...	...	...
United States	6,596	5,363	8,401	12,548	107,790	170,788	35,471
Others	141	...	...	58	67	...	6,140
Total	236,947	141,519	126,553	67,230	151,328	514,411	1,587,413
METAL-WORKING MACHINERY.							
United Kingdom	8,208	1,994	3,534	1,446	2,276	55,127	1,177,555
Other British territory	56	...	...	171	608	100	191
Total British Empire	8,264	1,994	3,534	1,617	2,884	55,227	1,177,746
Germany	64	3	...	...	...	...	6,572
Japan	...	...	256	31	166	9,014	8,507
United States	1,266	2,496	5,111	3,070	1,428	20,050	333,524
Others	137	...	...	...	...	268	21,397
Total	9,731	4,493	8,901	4,718	4,478	84,559	1,547,746
COAL-MINING MACHINERY.							
United Kingdom	7,284	8,152	6,891	6,022	2,336	9,608	62,032
Germany	1,765	...	...	...	...	...	...
United States	106	...	...	...	6,248	5,139	30,201
Total	9,155	8,152	6,891	6,022	[5] 8,677	14,747	92,233
OTHER MINING MACHINERY.							
United Kingdom	56,852	55,184	57,762	11,322	6,759	37,449	49,961
Other British territory	863	676	1,506	3,637	2,641	861	1,510
Total British Empire	57,715	55,860	59,268	14,959	9,400	38,310	51,471
Germany	329	...	...	...	...	...	...
Japan	...	14	208	...	...	...	...
United States	28,395	58,088	38,466	14,533	54,475	102,689	153,914
Others	106	[6] 9,480	18	...	255	...	...
Total	86,545	123,442	97,960	29,492	64,130	140,999	205,385

Articles and countries of origin.	1913-14	1915-16	1916-17	1917-18	1918-19	1919-20	1920-21
OIL CRUSHING AND REFINING MACHINERY.							
United Kingdom	£15,229	£11,316	£7,940	£3,552	£9,561	£10,109	£46,485
Other British territory			17		308	5,850	2,356
	15,229	11,316	7,957	3,552	9,869	15,959	48,841
Germany	3,023						
Japan				255			
United States	3,196	1,169	7,992	28,440	23,050	104,044	20,005
Others	10	117	83	683		856	8,631
Total	21,458	12,602	16,032	32,930	32,919	120,859	77,477
PAPER-MILL MACHINERY.							
United Kingdom	22,683	15,769	30,408	28,842	30,864	59,984	127,650
Germany	307	37					321
United States		1,571	2,589	6,825	7,043	17,449	11,011
Others	275			784	2,891	20,343	180,144
Total	23,265	17,377	32,997	36,451	40,798	97,776	319,126
REFRIGERATING MACHINERY.							
United Kingdom	13,079	6,436	11,074	2,248	1,260	12,363	105,622
Other British territory			593	619			
Total British Empire	13,079	6,436	11,667	2,867	1,260	12,363	105,622
Germany	6,517						
United States	2,813	1,048	448	2,637	2,538	5,952	116,823
Others	66		1	1,469		3	3,054
Total	22,475	7,484	12,116	6,973	3,798	18,318	225,499
RICE AND FLOUR-MILL MACHINERY.							
United Kingdom	43,928	20,156	21,585	14,589	22,682	71,945	307,153
Other British territory	99	1,249	3		134	248	2,146
Total British Empire	44,027	21,405	21,588	14,589	22,816	72,193	309,299
Germany	48,315	178					113,569
United States	13,899	9,226	14,286	14,302	14,693	26,802	51,408
Others	371	2,774	1,534	860	11,038	19,270	80,556
Total	106,612	33,583	37,408	29,751	48,547	118,265	554,832
SAWMILL AND WOOD-WORKING MACHINERY.							
United Kingdom	16,146	11,532	11,838	4,493	22,025	44,880	149,694
Other British territory	8	23	5	7	428		66
Total British Empire	16,154	11,555	11,843	4,500	22,453	44,880	149,760
Germany	964						2,369
United States	561	951	471	2,544	9,560	29,023	29,937
Others	55				556	2,510	408
Total	17,734	12,506	12,314	7,044	32,569	76,413	182,474
SUGAR MACHINERY.							
United Kingdom	25,101	15,767	15,984	1,973	4,166	28,417	147,864
Germany	5,868						
United States	186	1,318	705	1,953	3,063	148	162
Others		181	41	4,074	1,095	14,689	27,505
Total	31,155	17,266	16,730	8,000	8,324	43,254	175,531
TEA MACHINERY.							
United Kingdom	137,149	87,432	140,906	79,402	96,179	214,265	379,659
Other British territory	4,700	5,097	5,744	4,687	4,154	9,177	11,099
Total British Empire	141,849	92,529	146,650	84,089	100,333	223,442	390,758
Germany	373						
Others	16	57	108		175		316
Total	142,238	92,586	146,758	84,089	100,508	223,442	391,074

Articles and countries of origin.	1913-14	1915-16	1916-17	1917-18	1918-19	1919-20	1920-21
TEXTILE MACHINERY (COTTON).							
United Kingdom	£1,160,544	£769,179	£796,866	£679,957	£909,955	£1,215,613	£3,546,376
Other British territory	446	164	139	22	....	168	143
Total British Empire	1,160,990	769,343	797,005	679,979	909,955	1,215,781	3,546,519
Germany	9,970	....	3	....	....	....	621
Japan	7,586	26,393	46,035	57,803	85,018	14,046	15,519
United States	7,365	1,890	6,107	34,934	105,412	71,451	107,967
Others	5,784	2,402	9,170	4,220	1,763	6,349	3,225
Total	1,191,695	800,028	858,320	776,936	1,102,148	1,307,627	3,673,851
TEXTILE MACHINERY (JUTE).							
United Kingdom	968,820	599,494	682,032	413,325	362,594	1,363,243	2,686,398
Other British territory	....	....	....	64	....	....	....
Total British Empire	968,820	599,494	682,032	413,389	362,594	1,363,243	2,686,398
Germany	2,470	305	387	....	....	....	....
Japan	....	23,045	33,812	32,672	15,695	8,926	2,152
United States	....	713	343	11,792	2,045	105,530	87,551
Others	59	467	2,175	3,425	68	....	630
Total	971,349	624,024	718,749	461,278	380,402	1,477,699	2,776,731
OTHER TEXTILE MACHINERY.							
United Kingdom	22,187	25,463	13,559	20,291	43,736	46,330	126,972
Other British territory	7	....	....	....	200	....	532
Total British Empire	22,194	25,463	13,559	20,291	43,936	46,330	127,504
Germany	209	....	....	....	....	....	129
Japan	....	....	160	153	965	....	....
United States	509	497	233	131	1,471	926	6,046
Others	676	....	....	160	134	....	297
Total	23,588	25,960	13,952	20,735	46,506	47,256	133,976
SHUTTLES (EXCLUDING THOSE FOR SEWING MACHINES).							
United Kingdom	....	....	....	....	....	76,325	140,826
Japan	....	....	....	....	....	15,821	2,197
Others	....	....	....	....	....	....	37
Total	....	....	....	....	....	92,146	143,060
OTHER MACHINERY.							
United Kingdom	752,546	387,360	387,478	234,755	199,524	790,189	2,518,524
Other British territory	16,336	7,593	7,041	12,506	17,395	25,222	24,508
Total British Empire	768,882	394,953	394,519	247,261	216,919	815,411	2,543,032
Germany	64,436	1,254	....	....	....	....	9,938
Japan	2,811	2,112	7,274	41,115	55,843	10,439	4,983
United States	35,469	30,312	56,103	243,960	303,375	996,543	1,494,874
Others	15,814	5,269	1,606	22,232	24,751	69,687	82,494
Total	887,412	433,900	459,502	554,568	600,888	1,892,080	4,135,321

The following table shows the imports of machinery for the Government of India:

Articles and countries of origin.	1913-14	1915-16	1916-17	1917-18	1918-19	1919-20	1920-21
LOCOMOTIVES.							
United Kingdom	£611,835	£449,790	£17,533	£183,746	£122,229	£405,978	£1,251,630
United States	....	....	....	106	....	34,719	....
Total	611,835	449,790	17,533	183,852	122,229	440,697	1,251,630

Articles and countries of origin.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
RAILWAY CARS AND PARTS.							
United Kingdom	£1,209,466	£459,819	£81,402	£117,688	£294,014	£1,314,554	£1,004,583
Germany	3,734						
Belgium	1,330						
United States		1,854	7,991	1,276		2,263,324	300
Total	1,214,530	461,673	89,393	118,964	294,014	3,577,878	1,004,883
OTHER STEAM ENGINES AND PARTS.							
United Kingdom	23,156	7,289	16,346	37,035	16,965	170,059	363,524
Others			20		194	[1] 12,319	230
Total	23,156	7,289	16,366	37,035	17,159	182,378	363,754
OTHER MACHINERY.							
United Kingdom	177,680	120,010	121,555	134,527	226,971	233,651	485,056
Others	2,963	1,744	437	5,803	[2] 10,895	[3] 31,010	[4] 7,543
Total	180,643	121,754	121,992	140,330	237,866	264,661	492,599

[1] £10,819 from United States.
[2] £10,659 from United States.
[3] £30,766 from United States.
[4] £6,812 from United States.

The table below shows the distribution in India of the machinery included in the table beginning on page 140:

Articles and destination.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
LOCOMOTIVES (NOT GOVERNMENT).							
Bengal	£480,356	£386,116	£44,439	£33,583	£85,623	£263,158	£2,667,941
Bombay	601,428	420,398	70,480	25,544	81,304	140,908	1,489,167
Sind	46,917	17,128	6,344	1,580	5,550	29,577	52,675
Madras	199,519	162,432	27,925	24,083	35,117	78,946	624,212
Burma	62,865	33,420	28,508	926	5,433	16,381	28,476
Total	1,391,085	1,019,494	177,696	85,716	213,027	528,970	4,862,471
OTHER PRIME MOVERS.							
Bengal	191,261	96,591	97,052	78,786	86,054	295,071	672,240
Bombay	209,016	103,743	106,148	47,597	31,268	194,470	657,289
Sind	34,899	21,051	10,921	12,158	8,391	28,690	139,684
Madras	73,151	46,138	28,504	13,474	9,856	40,661	242,581
Burma	45,266	19,450	18,598	18,530	21,969	50,566	206,576
Total	553,593	286,973	261,223	170,545	157,538	609,458	1,918,370
ELECTRIC GENERATORS.							
Bengal	8,686	11,611	9,714	1,638	13,524	88,911	363,474
Bombay	5,399	268	9,773	386	304	107,505	88,696
Sind	1,506	2,302	1,462	1,139		2,152	10,321
Madras	3,251	375	218	700	293	21,772	23,297
Burma	2,040	643	1,123	1,071	1,178	31,889	53,890
Total	20,882	15,199	22,290	4,934	15,299	252,229	539,678
ELECTRIC MOTORS.							
Bengal	45,563	30,085	38,035	30,240	50,793	258,519	412,189
Bombay	24,469	9,278	14,761	5,106	17,130	55,867	124,795
Sind	1,299	1,536	1,753	1,376	312	3,225	12,315
Madras	18,930	11,162	30,310	6,281	7,677	16,347	37,437
Burma	2,296	1,872	5,737	4,161	933	9,915	27,036
Total	92,557	53,933	90,596	47,164	76,845	343,873	613,772

Articles and destination.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
TRANSFORMERS.							
Bengal	....	....	....	....	....	£2,271	£375
Bombay	....	....	....	....	....	....	9,329
Sind	....	....	....	....	....	194	4,086
Madras	....	....	....	....	....	6,670	998
Burma	....	....	....	....	....	16,940	28,639
Total	....	....	....	....	....	26,075	43,427
OTHER ELECTRIC MACHINERY.							
Bengal	£83,110	£67,883	£88,496	£84,046	£68,862	426,953	533,473
Bombay	110,429	61,061	71,638	44,278	80,600	139,958	279,026
Sind	2,153	562	2,573	2,584	6	1,987	4,012
Madras	24,783	12,773	10,317	1,589	7,720	15,923	48,212
Burma	11,382	7,869	7,159	8,625	11,126	33,683	62,776
Total	231,857	150,148	180,183	141,122	168,314	618,504	927,499
AERATED-WATER MACHINERY.							
Bengal	126	14	77	....	113	139	2,425
Bombay	3,231	1,017	365	273	1,073	2,884	9,067
Sind	668	500	191	163	81	258	3,789
Madras	291	....	....	....		184	504
Burma	957	106	75	158	....	454	356
Total	5,273	1,637	708	594	1,267	3,919	16,141
BOILERS.							
Bengal	110,895	64,517	68,035	45,699	124,466	354,582	786,167
Bombay	73,203	37,407	34,575	10,241	10,701	64,006	473,532
Sind	3,886	2,109	3,777	1,463	984	12,007	67,483
Madras	23,333	8,011	5,470	1,115	2,146	32,187	54,040
Burma	25,630	29,475	14,696	8,712	13,031	51,629	206,191
Total	236,947	141,519	126,553	67,230	151,328	514,411	1,587,413
METAL-WORKING MACHINERY.							
Bengal	962	596	87	3	....	2,335	754,431
Bombay	375	8	....	....	119	60,565	520,066
Sind	2,371	1,990	404	231	2,143	7,241	66,400
Madras	1,611	....	....	....	732	6,277	13,099
Burma	4,412	1,899	8,410	4,484	1,484	8,141	193,750
Total	9,731	4,493	8,901	4,718	4,478	84,559	1,547,746
COAL-MINING MACHINERY.							
Bengal	9,155	8,152	6,891	6,022	8,646	14,747	75,960
Bombay	....	....	....	....	....	....	16,157
Sind	....	....	....	....	31	....	116
Total	9,155	8,152	6,891	6,022	8,677	14,747	92,233
OTHER MINING MACHINERY.							
Bengal	9,278	1,462	2,750	2,594	2,594	13,599	26,770
Bombay	2,993	1,086	1,288	1,056	2,269	1,567	716
Sind	....	....	....	616	143	....	....
Madras	40,550	34,603	40,620	7,037	3,605	16,498	20,260
Burma	33,724	86,291	53,302	18,189	55,519	109,335	157,639
Total	86,545	123,442	97,960	29,492	64,130	140,999	205,385
OIL CRUSHING AND REFINING MACHINERY.							
Bengal	521	4,812	4,939	3,169	20,719	25,912	12,219
Bombay	2,512	188	475	1,202	2,499	1,975	22,328
Sind	906	901	10	....	....	855	16,745
Madras	1,513	214	2,876	96	3,371	84,325	2,395
Burma	16,006	6,487	7,732	28,463	6,330	7,792	23,790
Total	21,458	12,602	16,032	32,930	32,919	120,859	77,477

Articles and destination.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
PAPER-MILL MACHINERY.							
Bengal	£22,603	£16,549	£31,288	£32,074	£37,553	£76,637	£125,144
Bombay	662	828	1,709	4,377	3,245	2,647	3,935
Sind	....	....	....	....	....	....	247
Burma	....	....	....	....	....	18,492	189,800
Total	23,265	17,377	32,997	36,451	40,798	97,776	319,126
REFRIGERATING MACHINERY.							
Bengal	5,718	2,732	1,898	3,554	....	6,103	41,320
Bombay	12,901	1,325	996	786	2,559	2,788	84,014
Sind	988	2,573	4,762	2,307	192	1,603	88,950
Madras	....	....	32	....	....	3,143	915
Burma	2,868	854	4,428	326	1,047	4,681	10,300
Total	22,475	7,484	12,116	6,973	3,798	18,318	225,499
RICE AND FLOUR MILL MACHINERY.							
Bengal	18,393	9,900	8,182	4,416	7,845	17,074	121,378
Bombay	21,109	11,676	9,709	8,997	27,181	60,142	128,904
Sind	5,664	2,202	2,644	2,665	1,033	2,771	86,470
Madras	15,549	6,458	11,439	7,985	10,358	18,425	22,914
Burma	45,897	3,347	5,434	5,688	2,130	19,853	195,076
Total	106,612	33,583	37,408	29,751	48,547	118,265	554,832
SAWMILL AND WOOD-WORKING MACHINERY.							
Bengal	3,550	5,003	2,913	2,481	10,474	38,399	82,691
Bombay	2,842	....	2,675	1,327	13,365	14,158	11,376
Sind	253	60	273	954	236	1,845	24,000
Madras	2,472	210	401	....	245	997	3.641
Burma	8,617	7,233	6,052	2,282	8,249	21,014	60,766
Total	17,734	12,506	12,314	7,044	32,569	76,413	182,474
SUGAR MACHINERY.							
Bengal	25,226	11,843	12,609	6,159	6,050	37,476	142,755
Bombay	1,182	1,318	683	838	2,274	113	6,537
Sind	160	....	....	....	....	97	315
Madras	4,587	4,084	3,438	1,003	....	5,568	25,924
Burma	....	21	....	....	....	....	....
Total	31,155	17,266	16,730	8,000	8,324	43,254	175,531
TEA MACHINERY.							
Bengal	128,690	81,215	132,617	78,089	88,768	203,111	339,454
Bombay	21	....	....	59	....	....	....
Sind	....	74	163	....	....	....	....
Madras	13,527	11,297	13,978	5,941	11,740	20,331	51,620
Total	142,238	92,586	146,758	84,089	100,508	223,442	391,074
TEXTILE MACHINERY (COTTON).							
Bengal	73,122	49,366	48,807	29,914	53,809	174,347	428,206
Bombay	1,054,299	725,359	769,458	710,175	1,010,702	987,631	2,864,483
Sind	5,592	1,854	916	425	151	2,277	12,613
Madras	57,205	23,049	39,070	36,209	37,486	142,715	337,758
Burma	1,477	400	69	213	....	657	30,791
Total	1,191,695	800,028	858,320	776,936	1,102,148	1,307,627	3,673,851
TEXTILE MACHINERY (JUTE).							
Bengal	971,032	623,056	717,294	461,209	377,404	1,475,747	2,605,764
Bombay	....	....	....	....	....	....	255
Madras	317	968	1,455	69	2,998	1,952	170,712
Total	971,349	624,024	718,749	461,278	380,402	1,477,699	2,776,731

Articles and destination.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
OTHER TEXTILE MACHINERY.							
Bengal	£11,685	£4,304	£4,882	£6,869	£13,657	£14,654	£50,596
Bombay	730	...	1,575	3,471	15,423	10,664	35,797
Sind	3,529	5,424	4,381	3,418	11,705	17,488	31,996
Madras	7,166	16,232	3,114	6,977	5,721	4,450	15,587
Burma	478	...	...	...	...	...	...
Total	23,588	25,960	13,952	20,735	46,506	47,256	133,976
SHUTTLES (EXCLUDING THOSE FOR SEWING MACHINES).							
Bengal	...	...	...	...	...	4,802	8,970
Bombay	...	...	...	...	...	86,531	134,090
Sind	...	...	...	...	...	306	...
Madras	...	...	...	...	...	507	...
Total	...	...	...	...	...	92,146	143,060
OTHER MACHINERY (EXCLUDING PRINTING MACHINERY).							
Bengal	305,524	161,655	200,888	323,712	383,583	1,263,051	2,092,708
Bombay	390,636	189,617	156,825	141,901	135,412	336,826	1,282,883
Sind	18,759	13,551	8,816	8,122	6,638	54,059	141,204
Madras	131,672	47,213	58,171	38,196	31,899	146,987	403,401
Burma	40,821	21,864	34,802	42,637	43,356	91,157	215,125
Total	887,412	433,900	459,502	554,568	600,888	1,892,080	4,135,321
TOTAL MACHINERY.							
Bengal	2,505,456	1,637,462	1,521,593	1,237,257	1,440,537	5,057,598	12,449,975
Bombay	2,517,437	1,564,577	1,253,133	1,007,614	1,437,428	2,271,205	8,283,670
Sind	129,550	73,817	49,390	39,201	37,596	168,584	774,956
Madras	619,427	385,219	277,338	150,755	170,964	662,913	2,104,477
Burma	304,736	221,231	196,126	144,465	171,715	492,579	1,723,033
Total	6,076,606	3,882,306	3,297,580	2,579,292	3,258,240	8,652,879	25,336,111

The following table shows the distribution of the imports of Government stores:

Articles and destination.	1913–14	1915–16	1916–17	1917–18	1918–19	1919–20	1920–21
LOCOMOTIVES.							
Bengal	£139,258	£190,743	£1,294	£3,087	...	£34,719	£363,026
Bombay	...	...	...	592	£31,345	...	121,586
Sind	472,577	259,047	16,239	180,173	90,884	405,978	767,018
Total	611,835	449,790	17,533	183,852	122,229	440,697	1,251,630
RAILWAY CARS AND PARTS.							
Bengal	436,583	166,739	63,796	49,476	95,135	3,034,268	709,474
Bombay	...	34,238	880	26,015	113,250	87,252	11,051
Sind	777,832	260,696	24,717	43,473	85,629	456,358	283,656
Madras	...	...	...	...	...	...	702
Burma	115	...	...	...	...	...	...
Total	1,214,530	461,673	89,393	118,964	294,014	3,577,878	1,004,883

Articles and destination.	1913-14	1915-16	1916-17	1917-18	1918-19	1919-20	1920-21
OTHER STEAM ENGINES AND PARTS.							
Bengal	£2,753	£1,267	£1,389	£7,118	£6,598	£14,048	£11,688
Bombay	5,215	...	2,561	21,917	792	13,325	21,687
Sind	6,598	1,307	8,046	5,884	5,702	153,397	324,204
Madras	8,539	4,715	4,370	1,159	4,067	1,410	6,175
Burma	51	...	...	957	...	198	...
Total	23,156	7,289	16,366	37,035	17,159	182,378	363,754
OTHER MACHINERY.							
Bengal	42,178	47,914	26,269	61,317	161,985	140,713	114,815
Bombay	58,084	38,629	59,667	43,970	65,724	78,351	194,270
Sind	65,717	23,745	25,253	31,100	7,561	37,849	136,467
Madras	8,093	5,777	10,239	1,789	1,622	6,813	17,388
Burma	6,571	5,689	564	2,154	974	935	29,659
Total	180,643	121,754	121,992	140,330	237,866	264,661	492,599

Below are shown the exports of the principal classes of machinery from the United States to British India, according to official American statistics:

Classes.	1910 [1]		1913 [1]		1915 [1]		1918	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery	...	...	...	2,815	...	192	...	31,557
Concrete mixers	...	...	...	...	...	...	...	1,636
Cotton gins	...	...	45	13,175	3	877	5	881
Elevators and elevator machinery	...	...	...	1,468	...	377	...	317,812
Stationary gas engines	...	...	10	3,387	21	1,695	12	8,185
Gasoline engines:								
Automobile	...	...	2	175	...	...	12	3,000
Marine	...	...	74	8,146	179	18,208	123	76,684
Stationary	...	...	27	4,697	4	1,317	42	18,461
Traction	...	...	...	...	...	...	3	5,160
Kerosene engines	...	...	...	...	...	...	9	5,746
Steam engines:								
Locomotives	...	...	...	...	1	9,450	17	77,560
Marine	...	...	...	...	...	...	13	28,837
Stationary	172	41,758	3	3,080	18	5,891	6	2,970
All other engines	3	430	26	6,144	...	...	19	9,945
Boilers	...	...	...	...	...	...	...	61,035
All other parts of engines	...	25,954	...	9,569	...	20,734	...	11,723
Excavating machinery	...	...	...	...	...	...	...	20,000
Flour and grist mill machinery	...	...	...	69,346	...	69,776	...	2,412
Power laundry machinery	...	2,428	...	507	...	...	...	1,087
Lathes	...	...	...	...	...	...	...	239,604
Other machine tools	...	...	...	...	...	...	...	156,751
Sharpening and grinding machines	...	...	...	...	...	...	...	42,607
All other metal-working machinery	...	45,765	...	43,717	...	23,700	...	812,700
Oil-well machinery	...	...	...	...	...	275,203	...	231,092
Other mining machinery	...	127,505	...	279,777	...	38,256	...	69,627
Paper and pulp mill machinery	...	...	...	3,165	...	2,789	...	16,656
Pumps and pumping machinery	...	54,796	...	54,567	...	61,262	...	177,711
Refrigerating, including ice-making machinery	...	...	...	11,478	...	1,273	...	223
Road-making machinery	...	...	...	...	...	...	...	10,700
Shoe machinery	...	...	...	...	...	...	...	3,878
Sugar-mill machinery	...	...	...	750	...	544	...	4,201
Textile machinery	...	...	...	875	...	218	...	300,396
Sawmill machinery	...	...	...	36	...	1,957	...	13,830
Other woodworking machinery	...	2,319	...	12,828	...	7,543	...	18,759
All other machinery and parts of	...	215,483	...	98,361	...	84,477	...	751,909
Total	...	516,438	...	628,063	...	625,739	...	3,635,335

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery	....	61,220	....	119,325	....	380,398
Brewers' machinery	....	5,040	....	....	....	....
Concrete mixers	....	....	....	43,256	....	23,447
Cotton gins	13	2,247	....	15,790	....	1,170
Elevators and elevator machinery	....	124,275	....	50,401	....	108,243
Electric locomotives	....	....	1	3,847	9	151,418
Stationary gas engines	29	17,183	60	16,992	120	40,393
Gasoline engines:						
Automobile	14	4,936	96	25,568	6	2,046
Marine	102	107,675	109	35,721	73	23,463
Stationary	156	62,538	312	78,997	161	56,799
Traction	105	86,437	315	294,668	65	103,724
Kerosene engines	3	513	357	155,583	87	34,544
Steam engines:						
Locomotives	8	113,495	15	363,921	....	....
Marine	4	7,618	....	....	....	....
Stationary	54	85,769	24	32,530	45	44,296
Traction	....	....	18	94,776	....	....
All other engines	88	22,320	111	78,321	109	87,641
Boilers	....	110,598	....	52,395	....	109,816
All other parts of engines	....	122,158	....	246,311	....	309,542
Excavating machinery	....	950		81,508	....	115,254
Flour and grist mill machinery	....	28,966	....	30,492	....	2,077
Power laundry machinery	....	....	....	9,931	....	1,793
Lathes	....	94,993	....	195,646	....	84,975
Other machine tools	....	122,462	....	473,260	....	307,780
Sharpening and grinding machines	....	58,777	....	50,872	....	33,059
All other metal-working machinery	....	624,197	....	654,290	....	996,370
Oil-well machinery	....	299,313	....	471,347	....	1,604,992
Other mining machinery	....	169,384	....	149,196	....	286,268
Paper and pulp mill machinery	....	22,748	....	12,752	....	22,893
Pumps and pumping machinery	....	370,299	....	405,686	....	398,214
Refrigerating, including ice-making machinery	....	29,158	....	358,762	....	139,515
Road-making machinery	....	23,457	....	19,749	....	60,803
Shoe machinery	....	12,553	....	18,840	....	18,639
Sugar-mill machinery	....	12,636	....	841	....	5,808
Textile machinery	....	286,528	....	188,129	....	375,099
Sawmill machinery	....	30,152	....	9,692	....	61,107
Other woodworking machinery	....	100,202	....	70,494	....	76,195
All other machinery and parts of	....	1,601,339	....	3,201,675	....	4,705,110
Total	....	4,822,136	....	8,111,594	....	10,772,891

The following table shows British exports of machinery to India, according to British figures:

Classes.	1913	1914	1915	1916	1917	1918	1919
Locomotives:							
Via Bombay and Karachi	£453,720	£800,115	£536,793	£114,194	£137,616	£126,134	£350,948
Via Madras	80,289	85,961	132,940	16,062	14,828	17,841	27,677
Via Bengal, Assam, Bihar, and Orissa	251,718	730,170	546,457	54,574	23,854	99,962	180,233
Via Burma	52,754	14,115	19,608	26,585	295	3,473	794
Road rollers (British East Indies)	100,210	135,455	68,990	22,952	5,356	5,814	52,664
Agricultural machinery	62,444	93,947	49,688	20,196	3,696	736	19,985
Pumping machinery	93,028	86,215	60,721	55,416	48,792	25,622	115,368
Winding machinery	827	3,350	1,784	2,728	3,398	10,635	5,048
Steam engines	(1)	(1)	47,510	38,935	56,390	34,511	94,439
Steam turbines	(1)	(1)	9,112	11,492	4,427	2,691	5,079
Internal-combustion engines:							
Via Bombay and Karachi	(1)	(1)	59,590	75,264	44,890	23,078	137,055
Via Madras	(1)	(1)	27,316	21,443	8,849	3,674	17,659
Via Bengal, Assam, Bihar, and Orissa	(1)	(1)	40,498	43,433	17,365	18,126	68,484
Via Burma	(1)	(1)	7,847	7,682	5,145	4,607	8,743
Unenumerated prime movers:							
Via Bombay and Karachi	184,050	226,470	36,209	26,498	15,273	26,423	51,878
Via Madras	68,418	56,982	9,193	3,299	2,688	1,162	13,755

[1] Included in "Unenumerated prime movers."

Classes.	1913	1914	1915	1916	1917	1918	1919
Unenumerated prime movers—Continued.							
Via Bengal, Assam, Bihar, and Orissa...	£165,818	£245,553	£37,291	£60,554	£29,360	£41,854	£122,625
Via Burma..........	64,066	67,021	13,197	15,180	918	484	1,615
Electrical, all kinds:							
Via Bombay and Karachi..........	78,511	156,708	....	....	....	....	....
Via Madras..........	44,800	32,167	....	....	....	....	....
Via Bengal, Assam, Bihar, and Orissa..	151,756	154,168	....	....	....	....	....
Via Burma..........	18,317	18,811	....	....	....	....	....
Electric railway motors...	....	....	3,056	3,295	5,246	9,396	27,353
Other motors and generators..........	....	....	116,134	146,830	109,594	133,856	214,798
Unenumerated..........	....	....	70,691	77,318	53,182	44,424	118,914
Agricultural..........	35,367	44,004	26,185	16,750	6,496	3,187	25,696
Boilers (British East Indies)..........	245,942	241,468	144,857	151,057	100,586	71,782	301,907
Machine tools (British East Indies)..........	89,239	94,807	58,317	68,608	64,945	80,386	278,854
Mining machinery:							
Via Bombay and Karachi..........	11,139	10,524	5,083	4,664	2,392	732	2,314
Via Madras..........	64,144	28,812	28,708	37,180	16,622	8,688	19,336
Via Bengal, Assam, Bihar, and Orissa..	17,042	21,374	6,243	10,805	8,579	7,409	32,709
Via Burma..........	4,312	5,865	6,055	11,280	7,070	9,766	19,339
Sewing machines..........	1,230	2,320	1,978	40,857	24,305	313	1,434
Parts thereof..........	127,257	125,762	102,901	210,440	152,806	106,613	183,908
Textile machinery:							
Via Bombay and Karachi..........	984,787	....	....	....	....	....	....
Via Madras..........	64,634	....	....	....	....	....	....
Via Bengal, Assam, Bihar, and Orissa..	939,413	....	....	....	....	....	....
Via Burma..........	3,795	....	....	....	....	....	....
Spinning machinery:							
Via Bombay and Karachi..........	....	653,735	515,751	510,483	454,752	325,569	622,496
Via Madras..........	....	61,115	45,948	30,106	36,138	27,710	83,617
Via Bengal, Assam, Bihar, and Orissa..	....	385,101	365,907	410,534	314,751	278,422	800,332
Via Burma..........	....	2,265	400	22	436	1,681	1,572
Weaving machinery:							
Via Bombay and Karachi..........	....	282,189	134,981	133,789	279,012	482,941	478,192
Via Madras..........	....	6,372	5,233	7,507	8,387	12,229	21,201
Via Bengal, Assam, Bihar, and Orissa..	....	253,427	158,580	208,438	143,936	85,278	343,684
Via Burma..........	....	274	1,281	66	56	100	519
All other textile machinery..........	....	142,839	42,916	71,721	51,906	23,467	83,719
Unenumerated:							
Via Bombay and Karachi..........	316,782	323,437	187,770	177,080	142,836	110,185	282,231
Via Madras..........	114,796	89,328	67,022	72,301	42,150	20,849	78,368
Via Bengal, Assam, Bihar, and Orissa..	499,769	373,537	266,864	365,591	278,228	225,028	606,439
Via Burma..........	76,567	61,329	66,585	52,932	34,455	21,640	96,982
Total:							
Via Bombay and Karachi..........	2,326,853	2,883,379	1,795,821	1,388,419	1,306,071	1,328,503	2,469,601
Via Madras..........	518,881	417,424	379,689	257,928	172,915	110,258	346,288
Via Bengal, Assam, Bihar, and Orissa..	2,264,158	2,476,938	1,747,152	1,561,866	1,126,107	976,497	2,828,555
Via Burma..........	286,911	251,736	182,274	212,421	145,593	111,363	298,432
Grand total....	5,397,203	6,029,477	4,104,936	3,420,734	2,750,686	2,526,621	5,932,876

Japanese exports of machinery to British India are given below:

Classes.	1915	1916	1917	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Electric machinery..........	25,281	101,124	329,765	206,000	134,000	206,000
Telephones..........	241	309	2,832	4,000	5,000	4,000
Textile machinery..........	587,409	1,127,695	975,303	2,135,000	1,490,000	2,135,000
Lathes..........	....	....	136,838	241,000	36,000	241,000
Printing machinery..........	906	242	230	5,000	....	5,000
Other machinery..........	15,745	44,001	152,198	375,000	173,000	375,000

CEYLON.

EXTENT AND GENERAL CHARACTERISTICS OF THE MARKET.

As a market business men sometimes associate Ceylon with India. But as they are really distinct countries with separate governments, different laws, different steamship connections, and many other differences, it is also correct to separate the two markets. The relationship is much like that of their monetary systems. Just as the two territories have much in common, so they both use the rupee as a monetary unit, and its theoretical value is the same for both countries, although the exchange rate of the day may show a difference. And just as the two territories are distinct, so Ceylon divides the rupee decimally, while India has 16 annas equal one rupee, etc. In this report the two countries are treated separately for the sake of clearness, although most American manufacturers of machinery would include Ceylon in the territory of any traveler sent to India.

Colombo is the machinery market for Ceylon. All trade for the island and a part of the near-by sections of India centers here. Considered separately Colombo is not a large market for machinery. But Ceylon lies so close to the peninsula of India that it has been suggested that the two be connected by a bridge, and the waters are so shallow that steamships can not navigate the channel that lies between them, so that in a sense Colombo may be added to the five machinery markets of India as described in the preceding section of this report, being of less importance than Madras or Rangoon and comparing somewhat with Karachi both as to the total amount of machinery imported and also the American participation in that trade.

The following returns from the Ceylon Blue Books of the several years show the total value of the imports of industrial machinery into Ceylon:

Years.	Value.	Years.	Value.
	Rupees.		*Rupees.*
1913	3,621,819	1917	1,323,957
1914	2,178,478	1918	1,045,828
1915	1,935,547	1919	2,294,168
1916	2,542,583	1920	4,505,557

The rupee of Ceylon may be considered as worth 32 cents in American money during this period, except that shortly after the armistice its value started to rise and it was carried up to about 50 cents, after which it declined and by January, 1921, was nearly back to its old normal. Important fluctuations have occurred since, but the indications are that it will settle down at about its old value.

On page 6 of the general section of this report it has been shown that Colombo absorbed about $10,000 worth of American industrial machinery in 1915 and about $31,000 worth in 1918. It also appears

that in the former year American manufacturers supplied only about 1.6 per cent of the total imports while in 1918 their share had increased to 9.3 per cent.

The whole situation resembles that described as applying to India. Before the war purchases for Ceylon were made in London both for public and private use, but, unlike the condition in India, it seems that this will continue. Ceylon feels the influences encouraging industrial development and will make important improvements. Ceylon can and will absorb continually increasing quantities of American machinery. Americans have an interest in the machinery trade of Ceylon corresponding to that in the trade of India. The trade between Ceylon and the United States, according to the figures of the Ceylon Blue Book, is shown below:

Years.	Exports to United States.	Imports from United States.	Balance against United States.	Years.	Exports to United States.	Imports from United States.	Balance against United States.
	Rupees.	*Rupees.*	*Rupees.*		*Rupees.*	*Rupees.*	*Rupees.*
1912	33,228,235	1,951,446	31,276,789	1917	102,216,822	5,508,977	96,707,845
1913	38,695,405	2,383,672	36,311,733	1918	38,638,608	5,651,017	32,987,591
1914	31,441,319	2,287,710	29,153,609	1919	123,061,532	11,374,784	111,686,748
1915	52,629,516	4,830,217	47,799,299	1920	61,973,245	42,795,040	19,178,205
1916	83,568,214	7,735,352	75,832,862	1921	56,251,643	7,160,718	49,090,925

It is interesting to compare this with the corresponding returns for the total trade of Ceylon as indicated below:

Year.	Total exports from Ceylon.	Total imports to Ceylon.	Balance in favor of Ceylon.	Per cent of total balance represented by balance with United States.
	Rupees.	*Rupees.*	*Rupees.*	
1912	198,954,902	181,999,991	16,954,911	184
1913	234,863,554	199,640,797	35,222,757	103
1914	219,374,046	176,967,156	42,406,890	69
1915	273,377,180	165,446,038	107,931,142	46
1916	297,541,155	220,030,900	77,510,255	98
1917	306,944,957	185,146,221	121,798,736	79
1918	213,133,834	177,736,683	35,397,151	94
1919	367,057,479	242,719,690	124,337,789	90
1920	268,462,183	360,927,179	[1] 92,464,996	....
1921	256,600,413	262,055,710	[1] 5,455,297	....

[1] Balance against Ceylon.

AREA AND POPULATION.

Ceylon (25,481 square miles) is about the size of West Virginia (24,170 square miles), but has a population of 4,106,350 (1911 census) compared with 1,463,701 in West Virginia in 1920. In a sense Ceylon bears the same relations to India that Cuba bears to the United States, but Ceylon is much smaller than Cuba (44,218 square miles), being more like Haiti (29,821 square miles). Cuba has a population of 2,899,000 and Haiti approximately 2,500,000.

CITY OF COLOMBO.

Colombo is the capital and only really important city, and consequently is also the business, shipping, and social center of the

island. Its population is less than 200,000, with perhaps 2,500 Europeans (exclusive of the military). It is beautifully located and is so placed on the ocean highways that it is a port of call for nearly all steamers passing eastward through the Suez Canal for points in the Far East and Australasia. It is easily reached by tourists, and, as it is sometimes called "the paradise of earth," it is a pleasant playground, sightseers enjoying visits to Kandy and the many ruins of the ancient civilization that flourished about 1,000 B. C. or earlier. The archeologist, the naturalist, and the tourist find great pleasure in Ceylon. The climate is fairly uniform, with regular monsoons and rainy seasons, so that the traveler is always sure of weather that is not too hot and not too rainy, no matter what time of year he arrives, and by selecting the drier periods he is sure of delightful summer weather. There is also the advantage of being able to reach India by rail.

FEATURES OF DIFFERENT SECTIONS OF ISLAND.

But most travelers who leave Ceylon after a short visit at Colombo and Kandy have a very incorrect impression, for they have seen that section which is most favored by the southwest monsoon. Districts near Kandy have 150 to 200 inches of rain each year with great regularity, while those on the northwest coast beyond Anuradhapura have less than 50 inches. The really productive areas represent possibly 16 per cent of the area of the island along the southwest coast near Colombo, yielding coconuts, rubber, tea, and cocoa. There are other sections near the southern, eastern, and northern coasts planted in coconuts, but most of the remaining 84 per cent of the island is covered with jungle, wild, impenetrable, filled with monkeys, elephants, snakes, and other forms of an abundant wild life. Good roads make it possible for the tourist to motor to many interesting sections of the island, but other sections of great extent are inaccessible. As a consequence, the southwestern districts are densely populated and the plantations there attract workers from the outside, while in the north are districts where the lighter population is not so well employed and thousands of workers emigrate from Jaffna, near the northern tip of the island, to work on the plantations of the Malay Peninsula, going via Penang, Singapore, etc. The following table makes this difference clear:

Province.	Area.	Population.	Population per square mile.
	Sq. miles.		
Western	1,432	1,106,321	773
Central	2,288	672,258	295
Southern	2,146	628,817	293
Northern	3,578	369,651	110
Eastern	3,848	183,698	48
Northwestern	3,016	434,116	144
North central	4,009	86,276	21
Uva	3,271	216,692	66
Sabaragamuwa	1,893	408,421	215
Total for Ceylon	25,481	4,106,350	162

ECONOMIC POSITION OF CEYLON.

Ceylon is primarily an agricultural country, producing crops that are essentially tropical. The products cultivated and the area devoted to each are indicated in the statement below, showing their relative importance:

	Acres.		Acres.
Coconuts	925, 921	Coffee	810
Rice	678, 814	Cotton	152
Tea	505, 689	Cinchona	75
Rubber	281, 491	Other grains	146, 572
Cinnamon	37, 969		
Cacao	30, 851	Total	2, 622, 016
Tobacco	13, 672		

The total area of Ceylon is 16,307,840 acres, so that the planted area is about 16 per cent of the total, as stated above. It is of interest to add in connection with the above returns that the contract laborers on the various plantations are excluded from the population statistics given above, and it was estimated that on December 31, 1918, there were 803,620 such laborers on the island, of whom about 46 per cent were female. Probably most of these coolies come from central India in the Madras Presidency and near-by areas.

The importance of Colombo as a center for shipping has been mentioned. In 1919 there were 2,872 merchant vessels of 8,649,095 tons entered at that port, in addition to which there were 52 men-of-war and 121 transports. This works out to a total of 17,706,617 tons entered and cleared, which is by far the highest on record. During the war in 1917 and 1918 the figure was less than 7,000,000 tons per year. In 1913 and earlier years it approximated 15,000,000 tons.

The machinery used in Ceylon is principally that needed in the repair shops of Colombo, as employed in the repair of ship, railway, automobile, and plantation equipment, and in the manufacture of new machinery used for these purposes. At the end of this section are the statistics published by the customs authorities of Ceylon, the United States, and the United Kingdom, from which it is possible to arrive at an estimate as to the quantity of machinery of each of the several kinds that this market has absorbed in the various years. From this information it will be possible to judge the value of the market and devise appropriate sales methods.

In the trade statistics reference is made to textile machinery, and it will be noted that most of this "machinery" came from India. This, of course, is of the primitive patterns operated by human power and does not interest the American manufacturer.

MINERAL PRODUCTION.

Reference is often made to the gem mines of Ceylon, which produce several different kinds of precious or semiprecious stones, including rubies, sapphires, alexandrite, topaz, tourmaline, amethyst, opals, garnets, etc. This mining is so conducted that no machinery is required. Even the cutting and polishing of these gems is done in a very simple way and does not create a market for either machinery or abrasives in quantity.

Ceylon is also an important producer of plumbago, and the returns covering this trade might encourage one to believe that machinery

might be needed in this connection, but such is not the case; these operations are carried on in a very simple way, the mineral being dug from open pits. As the price in the market advances more pits start work. If the price declines, many stop production, and as the investment in plant is negligible, there is no overhead accumulating on idle equipment. The following table shows the number of gem quarries and plumbago pits and mines in operation in the years indicated:

Years.	Gem workings.	Plumbago workings.	Years.	Gem workings.	Plumbago workings.
1913	2,984	655	1918	430	453
1914	1,842	542	1919	1,454	143
1915	427	952	1920	2,168	101
1916	191	4,067	1921	(1)	26
1917	499	2,836			

[1] Figures not available.

This table is very interesting as showing the way in which the war in Europe stopped the tourist trade, and with it the trade in gems, but increased the manufacturing demand for plumbago and encouraged the production of this article in Ceylon. On the other hand, it can not be pretended that these figures are strictly accurate, as it is difficult to collect such statistics. It is much like trying to estimate how many gravel pits were worked in the United States during the same years. Many might be idle all the year or worked for only a few days, while others might be in regular production.

So far as could be learned, the only machinery used in connection with the above activities is a certain amount of simple pumping equipment in connection with certain of the plumbago mines; some of this equipment is now made locally.

MANUFACTURING INDUSTRIES.

The manufacturing statistics of Ceylon are as follows:

Mills.	1916	1917	1918	1919
Textile mills	1,370	2,464	1,497	1,465
Oil mills	2,655	2,838	3,045	2,670
Sugar mills	4	8	4	1

The "textile mills" indicated above are installations of hand-power equipment on the cottage-industry plan, and this industry is confined almost entirely to the Batticaloa district of the Eastern Province. The sugar mills are of negligible importance, it being noted from the agricultural statistics that no cane is planted in the island. The oil mills practically all operate on coconuts; out of the 2,670 reported for 1919, about 20 were of some consequence, 78 produced desiccated coconut, and 2,572 were "chekkoos." This last type of mill is a bullock-driven unit operating on the mortar-and-pestle principle; it is the type that was used on sugar cane in India very commonly up to about 50 years ago, but has now disappeared there. Modern vegetable-oil mills having hydraulic presses and the grinding and cooking equipment that goes with them are now being installed in Ceylon and probably will soon absorb the copra supplies of the

island. It is true that the protective tariffs of Europe may make it desirable to ship copra there rather than coconut oil. This is a subject that is somewhat involved, but, apart from the small mills that cater to the demands of the local people, it seems apparent that the hydraulic press will supplant the "chekkoo," just as the latter has been driven from the sugar-cane districts of India.

But it is worth noting in passing that wonderful tales are told of the effectiveness of the "chekkoo" in those districts where it is still used, and unless the traveler is somewhat critical he will be induced to believe that the hydraulic press is rather an ineffective device. The point deserves emphasis, as it is representative of the great difficulty of securing dependable reports in Asia. The "chekkoo" is proven to be a poor device on sugar in India, yet people still cling to it for use on coconut oil in Ceylon, the Philippines, etc., and in those districts will be found persons who, in a quasi scientific manner, will submit figures indicating the wonderfully perfect extraction that may, under ideal conditions, be secured. But, on the other hand, such reports are less than a half truth because they do not point out that these results can be sustained only by constantly overworking the bullocks. Similarly, in many parts of Asia, individuals will be found who will praise European engineering, locomotives, automobiles, etc., and condemn the corresponding American products with similar half truths. This comment goes further than the reports regarding the "chekkoos," as it often appears in certain of the newspapers there and in effect becomes a hostile propaganda that Americans should recognize and overcome.

In connection with coconuts it is interesting to add that, although these nuts are grown very widely throughout the Orient, in Africa, and in the West Indies and South America, Ceylon is apparently the only district that produces desiccated coconut, although the process employed in its manufacture is very simple. Similarly coir, the fiber made from the coconut husk that grows outside of the shell, comes exclusively from India and Ceylon, practically all of it being produced on the Malabar coast—that part of India on the west side of the peninsula from Goa southward. The familiar doormats, coir rope, etc., are made from this fiber, and the cheap labor, together with certain natural advantages possessed by the country, makes this monopoly of production possible.

The lists given in the preceding pages convey a very inadequate idea of the manufacturing industries of Ceylon. There are, in addition, 856 tea and rubber factories, mostly in the Western Province and the Province of Uva. There are 77 coir mills, 37 sawmills, 14 foundries and machine shops, 4 boat-building and repair yards, 191 carriage and rickshaw shops, 3 tanneries, ice and aerated water factories, etc., mostly located in or near Colombo.

FUEL.

But Ceylon can scarcely develop far in an industrial sense, because coal is not produced there. Large quantities of fuel are needed for ships as well as for the industries that have been developed, and it all has to be imported and is expensive. Indian coal that cost possibly $5 per ton in 1914 had risen in price to nearly $20 per ton in 1919. In general, Welsh as well as Indian coal can be

secured in Colombo, and the prices will approximate those charged in Bombay, as mentioned in the section of this report covering India. Coal has also been imported from Australia and South Africa.

For plantation or other similar service, railway pumping plants, etc., both oil engines and suction gas plants are used. Both types seem to be equally popular. Charcoal made from coconut shells is used in some of these gas producers, but is reported to overheat unless the producer is of very liberal dimensions. The central station for tramways, power, and light in Colombo is driven by Diesel engines of a variety of makes and of British, Belgian, and German manufacture.

LABOR.

As indicated by the previous remarks regarding the population, Ceylon has no shortage of industrial labor, and the men available can be trained to do good work. The large repair shops in Colombo and Nuwara Eliya are ample to maintain or repair any ordinary equipment. They can scarcely be considered suitable for manufacturing machinery, but they do produce a certain amount of standardized equipment when not too actively engaged on repair work, which, after all, is their principal business. The workmen in these shops do creditable work, and the fact that the Diesel engines in the electric power station perform satisfactorily also provides evidence that these workmen are good attendants. But, as is the case with other countries of Asia, the machinery sent to Ceylon should be as simple, rugged, and "foolproof" as possible.

IMPORT DUTIES.

Practically all machinery is admitted free of duty, but machinery to be driven by human or animal power is taxed 10 per cent. There is no preference under the law for the products of any nation as regards the amount of duty charged, although there is some thought of establishing such a distinction in connection with the policy of "imperial preference" also suggested for other parts of the British Empire.

Also, as in India, there is the "Merchandise Marks Act" under which rather severe fines are sometimes imposed by the authorities for failure to have non-British goods bear an indication of the country of origin. This law is too long and involved in statement to be quoted here; copies are on file in the Department of Commerce and can be referred to there in cases where this is desired.

As applied to machinery, this act aims to penalize those who forge or falsely apply trade-marks or who apply "any false description to goods," etc. It is further set forth that the expression "trade description" means "any description, statement, or other indication, direct or indirect, * * * as to the place or country in which any goods were made or purchased * * * ," etc. Also, "in the case of imported goods evidence of the port of shipment shall be prima facie evidence of the place or country in which the goods were made or produced."

The customs authorities are charged with the enforcement of this act as applied to imports, and are given wide authority in establishing rulings for this purpose.

For the purposes of the act it is assumed that as the English language is the language of the British Empire goods marked in any way using English words are presumably of British origin, and for the purposes of the act fraud is intended if foreign goods do not also show the country of origin.

"Where there is on any goods a name which is identical with, or a colorable imitation of, the name of a place in the United Kingdom or this colony, that name, unless accompanied in equally large and conspicuous letters by the name of the country in which such place is situated, shall be treated for the purposes of this section, as if it were the name of a place in the United Kingdom or this colony."

To illustrate by an example: American stockings marked "double sole" on the fabric itself, as is so customary, regardless of what may be on box or wrapper, must also be marked "Made in U. S. A." on the stocking itself or wherever else words in the English language are used. Matches marked only with Swedish words will pass without the words "Made in Sweden," as the language suggests the origin.

The expression "Made in U. S. A." has, up to this time, been considered a sufficient description of the country of origin. Those who ship machinery to Ceylon (or other territories under British control, as India, etc.) should make sure that the expression "Made in U. S. A." appears conspicuously wherever other words appear, as there is a strong disposition to enforce the above act rigidly and a considerable number of fines have been imposed on Americans in recent years. For example, spark plugs are often marked and little space remains on which to mark "Made in U. S. A.," but it is very necessary to do so.

This matter is covered more completely in connection with the part of this report covering India, which should also be read by those seeking further information on this subject (see p. 136). The Department of Commerce also has considerable further information on this subject, which is available for those having specific problems of this sort.

Perhaps it should be pointed out that manufacturers should not feel this requirement irksome, as the indication "Made in U. S. A." is an asset and is generally recognized abroad as implying that the article so marked is of superior quality.

WATER POWER.

Because of the cost of fuel there has been a certain agitation for the development of the water-power resources of the island. So far as the writer could see there was little that would support the capital charges involved in such a development except for the demands of Colombo. However, there is talk of a much wider development, and it is possible that cheap power might result in stimulating industrial development in Ceylon. So far as could be seen, present industrial development and present railway traffic would scarcely justify such a project. For the purposes of this investigation the Government of India lends experts to Ceylon, and so far as can be seen at the moment there is a great deal of preliminary work necessary before the plans can take definite form for either the larger or smaller projects suggested.

RAILWAYS.

From the beginning it has been hoped that the railways of Ceylon would some day be connected to those of India and as a consequence most of the lines on this little island are of 5-foot 6-inch gauge, the mileage in 1919 being 610½ miles on that gauge and 117 miles on 2-foot 6-inch gauge.

The harbor facilities of Colombo are good, and heavy packages can be handled with comparative ease. Loads in excess of 5 tons require special care, and such large packages should not be shipped if it is possible to avoid it. Cranes are available for pieces up to 35 tons if actually necessary.

Generally speaking, the roads of Ceylon are good and packages that can be placed on a truck can be delivered quickly to any point on the best highways. Such conditions are far better than in most other parts of Asia, but even in Ceylon the packages should be as light and small as is reasonably possible, especially for such articles as are to be delivered to a plantation or plumbago mine or new coconut-oil mill, as these are frequently in newly opened territory beyond the reach of existing good roads.

DETAILED STATISTICS OF MACHINERY TRADE.

In considering the following statistics one should remember that the year 1918 witnessed the laying of numerous embargoes on American exports of machinery, and the scarcity of shipping contributed to restrict American exports. The same influences are reflected in other years in connection with the exports from other countries.

The railway and other Government enterprises purchase their equipment through the Crown agent in London, and as a rule this agent restricts his purchases to British sources of supply.

A comparison of the following returns from the Ceylon Blue Book suggests that the Ceylon authorities do not include materials imported for the various Government departments, including the railways:

TOTAL IMPORTS OF MACHINERY INTO CEYLON.

Classes of machinery.	1913	1914	1915	1916	1917	1918	1919	1920
	Rupees.	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*
Foundry and machine shop	1,095,036	664,590	561,504	732,271	323,473	186,157	536,146	1,246,696
Oil making	52,382	23,359	27,411	132,289	13,443	15,113	121,403	110,534
Spinning and weaving	20,819	11,810	12,383	17,206	1,709	86,210	63,924	132,905
Tea	660,335	560,435	488,788	669,181	380,484	322,621	259,403	798,170
Others dutiable	57,805	46,425	15,508	53,511	118,488	46,121	91,365	196,545
Others free	1,735,442	871,868	829,953	938,125	486,360	389,606	1,221,927	2,020,704

PARTICIPATION OF UNITED STATES IN MACHINERY TRADE OF CEYLON.

Years.	Total machinery imports.	Imports from United States.	Percentage from United States.	Years.	Total machinery imports.	Imports from United States.	Percentage from United. States.
	Rupees.	*Rupees.*			*Rupees.*	*Rupees.*	
1913	3,621,819	102,330	2.8	1917	1,323,957	135,338	10.2
1914	2,178,478	79,966	3.7	1918	1,045,828	97,970	9.3
1915	1,935,547	30,529	1.6	1919	2,294,168	423,050	18.5
1916	2,542,583	194,116	7.6	1920	4,505,557	424,461	9.4

CLASSIFICATION OF MACHINERY FROM THE UNITED STATES.

Classes of machinery.	1913	1914	1915	1916	1917	1918	1919	1920
	Rupees.	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*
Foundry and workshop	15,202	11,632	5,232	21,898	22,497	2,129	49,622	21,721
Oil making	8,672	18,466	10,912	76,818	7,862	14,083	112,731	108,778
Tea	...	...	...	...	...	5,317	...	...
Other dutiable	113	176	83	...	6,374	496	6,206	35,270
Other free	78,343	49,692	14,302	95,400	98,605	75,945	254,491	258,692
Total	102,330	79,966	30,529	194,116	135,338	97,970	423,050	424,461

NOTE.—In connection with the above it is necessary to remember the embargoes on the exportation of American machinery and the shortage of shipping experienced in 1918. Other countries had corresponding difficulties in 1918 and other years.

CLASSIFICATION OF MACHINERY FROM THE UNITED KINGDOM.

Classes of machinery.	1913 [1]	1914 [1]	1915	1916	1917	1918	1919	1920
	Rupees.	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*
Foundry and workshop	1,074,608	650,519	554,495	707,825	293,656	165,239	481,692	1,223,469
Oil making	40,573	3,405	16,499	52,556	4,398	830	8,672	1,656
Spinning and weaving	15,039	7,332	6,737	1,366	...	...	64	79,840
Tea	659,723	558,853	488,763	658,642	369,037	286,279	246,880	755,351
Other dutiable	52,983	40,595	13,185	870,878	101,709	32,101	78,983	149,190
Other free	1,407,333	696,104	625,461		335,119	261,347	913,963	1,649,213
Total	3,250,259	1,956,808	1,705,140	2,291,267	1,103,919	745,796	1,730,254	3,858,719

[1] In 1913 the United Kingdom is also credited with "Locomotives, excluding railway," amounting to 16,127 rupees, and in 1914 a similar item amounted to 5,562 rupees.

NOTE.—As indicated in the text, there is reason to believe that the returns of the Ceylon customs do not include importations for account of the government. The returns of the United Kingdom on p. 161 afford an interesting comparison.

CLASSIFICATION OF MACHINERY FROM JAPAN.

Classes of machinery.	1913	1914	1915	1916	1917	1918	1919	1920
		Rupees.	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*	*Rupees.*
Foundry and workshop	...	...	...	...	...	11,200	...	...
Oil making	...	...	...	...	...	...	...	...
Spinning and weaving	...	...	...	...	687	7,062	8,451	...
Tea	...	...	...	1,855	...	...	...	...
Other dutiable	...	7	63	65	...	6,685	951	1,579
Other free	...	...	...		...	26,834	...	...
Total	...	7	63	1,920	687	51,781	9,402	1,579

NOTE.—Trade statistics as issued by the Japanese customs do not show that any machinery was shipped to Ceylon. It may be that any such shipments would be included under "British India" or "Other Asiatic countries."

The United States customs returns record the exports to "India," to "Straits Settlements," and to "Other British East Indies." Technically, this last would include Ceylon and also British North Borneo, with possibly one or two other possessions. Practically, nearly all of this machinery is shipped to Ceylon and, as nearly as may be, represents the value of the Ceylon market—allowance being made for the demands of the petroleum industry, etc., in Borneo. The following table shows the official American statistics of exports to "Other British East Indies."

Classes.	1910 [1]		1913 [1]		1915 [1]	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Stationary gas engines			1	90		
Gasoline engines: Marine			1	300	11	715
All other engines					1	60
All other parts of engines						161
Flour and grist mill machinery				68		
Power laundry machinery				80		
Metal-working machinery				3,007		450
Oil-well machinery						6,536
Other mining machinery				1,018		4,122
Pumps and pumping machinery		3,357		5,836		938
Woodworking machinery				27		185
All other machinery and parts of		17,197		8,954		1,246
Total		20,554		19,380		14,418

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery				50		
Elevators and elevator machinery		1,021				130
Stationary gas engines			7	3,882		
Gasoline engines:						
Automobile			1	107		
Marine	8	5,657	1	580	1	255
Stationary	9	4,960	1	485		
Traction	13	8,110	17	11,160		
Kerosene engines	4	1,731	1	395		
Steam engines: Stationary	1	8,062	3	20,153		
All other engines		11		19,323	1	10,049
Boilers						
All other parts of engines		1,281		7,602		2,107
Flour and grist mill machinery				59		
Lathes		3,483		1,855		
Other machine tools		1,933		3,924		1,289
Sharpening and grinding machines		4,067		501		
All other metal-working machinery		3,271		10		
Oil-well machinery		13,662		16,374		6,956
Other mining machinery						
Pumps and pumping machinery		14,579		7,788		6,930
Road-making machinery		4,052				95
Shoe machinery		810				108
Textile machinery				20		95
Sawmill machinery				568		232
Other woodworking machinery				3,333		343
All other machinery and parts of		41,302		52,063		22,084
Total		118,054		150,232		50,673

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.

According to the British Annual Statement, the exports of machinery from the United Kingdom to Ceylon have been:

Classes.	1913	1914	1915	1916	1917	1918	1919
Locomotives	£107,124	£52,931	£15,276	£6,154	£2,473	£3,645	£6,899
Unenumerated prime movers	62,833	43,687					
Internal-combustion engines			28,808	33,268	11,564	2,586	41,235
Unenumerated engines			2,966	3,494	489	137	9,002
All other	194,095	141,392	111,599	126,901	74,845	46,747	110,297
Total[1]	364,052	238,010	158,649	169,817	89,371	53,115	167,433

[1] This total includes sewing machines, typewriters, agricultural machinery, etc.

Another publication, the British Statistical Abstract for Colonies, Dominions, etc., No. 53, page 84, gives the following as the total amounts of machinery imported from the United Kingdom into

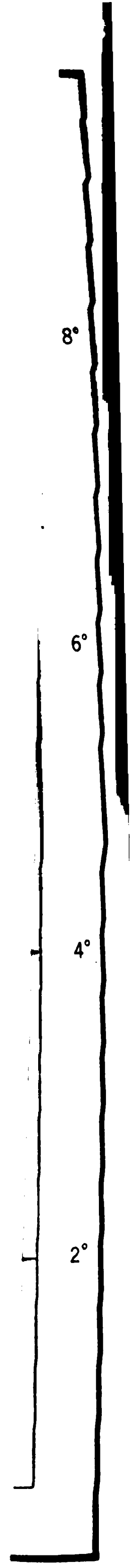
Ceylon. It is evident that different classes of goods are included, since marked discrepancies exist:

1901	£98, 563	1910	£148, 622
1902	63, 300	1911	183, 306
1903	77, 121	1912	234, 710
1904	73, 687	1913	293, 717
1905	53, 764	1914	186, 560
1906	76, 301	1915	146, 014
1907	83, 010	1916	205, 217
1908	93, 361	1917	153, 070
1909	121, 685		

The pound may be taken as equal to approximately $4.86 United States currency, or 15 rupees Ceylon currency, throughout this period.

In 1920 the form in which British returns were published was changed. The revised figures are shown below; these returns appear to omit locomotives and some other items included in the earlier returns:

Classes.	1913		1919		1920		
	Tons.	Value.	Tons.	Value.	Tons.	Number.	Value.
Lathes					46	25	£6,213
Internal-combustion engines			494	£41,325			
Gas engines					228	34	21,949
Oil engines					389	80	37,095
Unenumerated prime movers	1,327	£62,833	100	9,002			
Machinery, not elsewhere specified	2,738	131,255	834	72,204	389		52,733
Machinery parts, not elsewhere specified					1,369		161,720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MALAY PENINSULA.

OUTLINE OF DEVELOPMENT.

ıe map opposite this page shows the general size and shape of Malay Peninsula. South of the Siam boundary the entire area ıder British control. It is interesting to remember that although British occupied Penang in 1786 and Singapore in 1819 they did control the remainder of the territory and it was practically all ıgle and very badly misgoverned as late as 1874. In that year British intervened in the affairs of the Malay States, and since ən conditions have improved greatly. Previously the virgin jungle ıs unmolested, and the Malay population of about 300,000 lived in ude wooden huts with roofs of palm thatch. These settlements ere always on the bank of a stream, and water was the only highay. In the entire territory there was but one road, and that was nly 12 miles long. The only cultivation of any consequence at all was a small rice-producing section in the extreme northwest, in Kedah. Within the lifetime of the present generation of business men this entire territory of most valuable land was given over to the most extreme barbarism, and within a short half century it has developed into a peaceful and prosperous territory of great productiveness and is one of the most important tin-producing sections of the world as well as of the highest importance as a producer of rubber. The jungle is rapidly giving way to civilization, and great progress is to be expected during the next few years. The progress already made is indicated in the following paragraphs.

GEOGRAPHICAL DIVISIONS AND POLITICAL ORGANIZATION.

South of the Siam boundary are the "Straits Settlements," the "Federated Malay States," and the "Non-Federated Malay States," and it is necessary to distinguish clearly between these if one is to interpret trade statistics accurately. In various ways and at different times the British secured possession of Singapore, Penang, Malacca, Dindings, and Province Wellesley. Each of these is an isolated territory or settlement and in size might be compared with the District of Columbia. They were little more than trading posts at first, but as they were British soil they were provided with a government, and it has been found convenient for administrative purposes to combine with them the other British settlements on the island of Labuan off the north coast of Borneo and also the Keeling and Christmas Islands far off in the distant parts of the Malay Archipelago. To this group the British have given the name of Straits Settlements, establishing a capital in Singapore and placing the whole under a governor located there.

In 1896 the Malay States of Perak, Selangor, Negri Sembilan, and Pahang agreed to form a federation under the executive control of the British, which is exercised through a resident general at the

capital Kuala Lumpur; he, in turn, is under the direction of the governor of the Straits Settlements, the latter also having the title of high commissioner for the Federated Malay States. There were several States that did not join this federation; these are still under their Malay sultans and are the so-called Non-Federated States, each being at least nominally independent, though British influence is strong in each of the four—Kedah, Kelantan, Trengganu, and Johore. In 1909 Siam ceded its rights over these States to Great Britain.

For various reasons the Non-Federated Malay States have not yet attained much development; the Federated States have done remarkably well; while the Straits Settlements are merely shipping centers and as such represent very little in the way of either production or consumption.

SINGAPORE AND PENANG AS MACHINERY MARKETS.

The machinery markets of this territory are Singapore and Penang. Some of the machinery merchants of these cities also maintain branches and, possibly, repair shops at Kuala Lumpur or Ipoh. As has already been indicated on page 6, the total machinery trade of Singapore is $1,000,000 per year, more or less, and of Penang perhaps $400,000, so that these cities do not rank very high among the markets of Asia. On the other hand, one gets the impression that these cities are far more important than these bare figures indicate, because of the importance in world trade of the tin and rubber as well as other business centering there. The mere geographical position of Singapore gives it great importance as a distributing center for all this part of the Orient. At the end of this section are the usual statistical tables showing in detail, so far as possible, the volume and the nature of the machinery imports of the Straits Settlements and also of the Federated Malay States. In studying these statistics the above distinction should be clearly drawn, for probably the only ports in the Federated Malay States that are used for the importation of machinery are Port Swettenham, Klang, and Port Dickinson.

DESCRIPTION OF THE FEDERATED MALAY STATES.

Under the report on the Dutch East Indies a brief description is given of conditions in Sumatra and Borneo. In the report on China is a similar reference to the situation in Siam. The other territories drawing supplies from the cities of the Straits Settlements are the Malay States. No description of the Non-Federated States is necessary, as they absorb only a very small quantity of machinery. The following data applies to the Federated Malay States. Their area is 27,623 square miles (Indiana, 36,534 square miles). The forest reserves amount to 2,792 square miles. The area planted (considering only estates of over 100 acres extent) is: Rubber, 672,106 acres; coconuts, 70,868 acres; tapioca, 1,740 acres; gambier, 1,511 acres; coffee, 1,301 acres; various, 4,565 acres; total, 752,091 acres, equaling 1,175 square miles, or about 4½ per cent of the total area.

The population consists of the Malays, who are not very active; the Chinese, to whom should be given much of the credit for developing the country, as they have done a very great deal in tin mining

and merchandising, as well as some planting; the Indian element, brought in for plantation labor; and the European element, the governing and capitalistic element. The 1911 census gives the following returns: Europeans and Americans, 3,284; Chinese, 433,244; Malays, 420,840; Indians, 172,465; others, 7,166; total, 1,036,999 (Indiana, 2,930,554). It is estimated that by the end of 1918 this had become 1,279,859, an increase of 23 per cent. However, Pahang, the largest of the States and comprising over half of the area, is very lightly populated. Selangor is the most productive region

Between Singapore and Penang is a railway that has been extended northward and now connects through Siam to Bangkok, a total distance of 1,188 miles (to travel over which requires four days, as compared to about 22 hours for the 912 miles between New York and Chicago), built on a 3-foot gauge. From Singapore to Penang is about 490 miles, but including branch lines the Federated Malay States Railways had a total of 949 miles at the end of 1918. This is being rapidly extended, especially by a line along the eastern side of the peninsula. Paralleling and supplementing the above railway are 2,343 miles of first-class roads, which are well built and largely used by automobiles. Although the entire area south of the Siam boundary, including the Non-Federated States, is about the area of the State of Georgia, with a population of about 2,650,000 in 1911, the most productive section of the country is that along the railway, where in a district about the area of the State of Connecticut, with a population of about 1,000,000, a very large part of the rubber and tin supplies of the whole world are produced. Apart from these industries very little machinery is required in this section, but as these enterprises have been pushed to a very high development it is felt that they deserve special description.

RUBBER PRODUCTION ON PLANTATIONS.

The United States consumes about two-thirds of the world's rubber, but, except for a trifle from the Philippine Islands, produces none. The world's production has expanded from about 54,000 tons in 1900 to 265,000 tons in 1917, and it has been estimated that it will reach 660,000 tons by 1925. Consequently, as a people, we have a great interest in rubber.

Rubber is produced from the sap of a variety of trees and vines, but the best market price is paid for "Para," which is obtained from a tree with the botanical name *Hevea Braziliensis*, which grows wild over possibly 1,000,000 acres in the Amazon Valley. The sap is secured by making an incision in the bark and collecting the exuding milk in cups. This is gathered and, among other methods, the rubber is coagulated out of the juice by treatment with acetic acid. As this is usually done in an oblong pan, the resulting cake is a white curd not unlike blancmange in appearance. The surrounding watery fluid is wasted. In the above form the rubber contains a great deal of water, part of which is removed by being passed through rolls. Later it is hung up to dry, and frequently is smoked to prevent the formation of mold.

Until 1913 the chief source of supply was Brazil, where the latex was taken from the trees as they were found growing wild in the

forests. In the Orient the tree is grown on plantations, and, although Ceylon plantations date from perhaps 1884, plantation rubber did not exceed 10 per cent of the world's supply until about 1910, at which time the world's production was about 70,000 tons and the price was $1.10 to $1.30 per pound. In 1920 the world's production had become about 343,731 tons, of which the United States imported 252,922 tons, or nearly 74 per cent. Of the 1920 importations 89 per cent were of "plantation rubber" and 11 per cent of "wild rubber." The story of rubber is a fascinating illustration of the way in which production by modern methods is superior to the less scientific processes of earlier years. The following table, covering the world's production of crude rubber (from figures compiled by W. H. Dickinson & Son, of London, and tabulated by the National Bank of Commerce, New York), tells the story:

Years.	Plantation.	Brazil.	Native areas other than Brazilian.	Total.	Percentage of plantation.
	Gross tons.	*Gross tons.*	*Gross tons.*	*Gross tons.*	
1900	4	26,750	27,136	53,890	[1]
1901	5	30,300	24,545	54,850	[1]
1902	8	28,700	23,632	52,340	[1]
1903	21	31,100	24,829	55,950	[1]
1904	43	30,000	32,077	62,120	[1]
1905	145	35,000	27,000	62,145	[1]
1906	510	36,000	29,700	66,210	1
1907	1,000	38,000	30,000	69,000	1
1908	1,800	39,000	24,600	65,400	3
1909	3,600	42,000	24,000	69,600	5
1910	8,200	40,800	21,500	70,500	12
1911	14,419	37,730	23,000	75,149	19
1912	28,518	42,410	28,000	98,928	29
1913	47,618	39,370	21,452	108,440	44
1914	71,380	37,000	12,000	120,380	59
1915	107,867	37,220	13,615	158,702	68
1916	152,650	36,500	12,448	201,598	76
1917	213,070	39,370	13,258	265,698	80
1918	255,950	30,700	9,929	295,579	86
1919	285,225	34,285	7,350	326,860	87
1920	304,816	30,790	8,125	343,731	89

[1] Less than 1 per cent.

It requires about six to eight years for a rubber plantation to develop into an active producer, and, as the business has been highly profitable, planting has been very active. Rubber is probably the only commodity that did not increase in price during the war, and during 1920–21 the price fell rapidly until early in 1922 it was down to about 16 to 18 cents. The price in July, 1914, was 60 cents.

Of the 60 per cent of the world's supply of rubber absorbed in the United States, about 70 per cent is used in the manufacture of tires and tubes. Next to the United States, Great Britain is the largest consumer of rubber, but it absorbs only about 10 per cent of the world's production. Plainly the United States is the leading producer of machinery for manufacturing rubber and should be interested in machinery used in its production.

The beginnings of the present plantations were experiments made about 1884, when the extensive coffee plantations of Ceylon were ruined by a disease which attacked the plant and destroyed the industry, and planters sought other products that might be grown. As a tree should not be tapped until it is about 8 years old, it

required a long time to complete experiments and get into active production. Even in 1900 the reports refer to the sale of a parcel of 327 pounds of rubber in London, this having been taken from 82 trees. However, it was about this time that it became certain that the business would be very profitable, and in 1906 it was estimated that 40,000 acres had been planted in the Federated Malay States. The following figures show the areas devoted to rubber plantations: Federated Malay States (1918), 672,106 acres; Ceylon (1919), 308,687 acres; India (including Burma) (1918), 124,230 acres; Dutch East Indies (1918), about 500,000 acres. These returns were taken from the agricultural statistics of the several countries visited, but it should be remembered that this industry has been growing very rapidly. The following table showing the location and area of rubber plantations on January 1, 1920, was prepared by the British Rubber Growers Association and published by the National Bank of Commerce; the writer has not been able to verify these figures:

Countries.	Planted.		Producing.	
	Acres.	Per cent of total.	Acres.	Per cent of total.
Malaysia	1,750,000	53	1,250,000	56
Dutch East Indies	885,000	27	570,000	25
Ceylon	398,000	12	267,000	12
South India	65,000	2	43,000	2
Borneo and Sarawak	50,000	1	30,000	1
Burma	45,000	1	17,500	1
Other countries	130,000	4	60,000	3
Total	3,323,000	100	2,237,500	100

Altogether it would seem that there are perhaps 800 to 1,000 plantations, scattered as indicated, each of which has its own factory for coagulating, squeezing, and washing the rubber. The mechanical equipment of one of these factories consists of an engine of from 20 to 100 horsepower. Usually these are oil engines of the semi-Diesel type, very commonly from such European makers as Hornsby, Ruston-Proctor, or Bronz. The mangles are sometimes driven by hand, but usually by power, and are equipped with different designs of rolls, depending upon whether the product is to be sheet or crêpe rubber. A certain amount of this sort of machinery is made in the local shops, but a great deal is also imported. The machinery used most commonly is from the European shops of Shaw, Robinson, Bridge, or Nering Bögel. So far as known, no American manufacturer has entered this trade.

Ordinarily the drying equipment is not of refined design, but there is some prospect that more scientific methods will be adopted. Also. there is a possibility that a system of drying the latex will be substituted for the present process of coagulation with acetic acid (or its equivalent). This whole industry is still young, but it is being treated very scientifically on the agricultural as well as the manufacturing side, and important results may develop at any time. In connection with the rubber plantations and also the coconut and African oil palm plantations of these districts, there will probably develop an important market for tractors of several different types.

The labor for these plantations is very commonly brought in from northern Ceylon and the Coromandel (Madras) coast of India, the laborers being mostly Tamils, of whom there were about 145,000 in 1911, the time of the last accurate census. However, the number has probably more than doubled since then. The coolie traffic thus leaving the Madras Presidency alone probably exceeds 1,500 per week.

TIN MINING.

The world's output of tin in 1918 is estimated to have been 131,000 metric tons, a small decrease from that of 1917. The output in the various tin-producing countries from 1913 to 1918 is shown in the table below. The figures given are based on official reports and, as far as possible, are those of mine output; but for some countries, such as Bolivia, China, Siam, and Nigeria, the figures represent exports. Where the output is given in the original sources in terms of tin-bearing concentrate—as, for example, it is for the Australian States—it is here given in terms of metal obtainable by smelting:

Countries.	1913	1914	1915	1916	1917	1918
	Metric tons.	*Metric tons.*	*Metric tons.*	*Metric tons.*	*Metric tons.*	*Metric tons.*
Federated Malay States	50,920	49,820	47,520	44,570	40,470	37,970
British-protected Malay States	1,800	2,700	4,170	4,450	4,500	4,500
Bolivia	26,760	22,360	21,900	21,330	28,820	28,000
Banca	15,940	14,630	13,660	14,460	13,540	11,000
Billiton and Singkep	5,300	6,090	6,760	6,780	7,300	9,200
China	8,390	7,120	8,000	7,630	11,800	12,000
Siam	6,660	6,740	8,520	8,960	8,600	8,600
Nigeria	2,950	4,590	4,630	5,150	7,070	7,000
Australia	8,160	5,520	5,680	5,550	4,970	4,900
Cornwall	5,370	5,140	5,060	4,770	4,000	4,000
Union of South Africa	2,050	2,000	2,050	1,900	1,540	1,500
Other countries	1,410	1,500	1,500	1,700	1,800	2,000
Total	135,710	128,210	129,450	127,250	133,910	130,670

In this connection it should be noted that the Asiatic producing territories mentioned above are in reality one long field, starting in Banca and Billiton and passing northward up the Malay Peninsula through both Siam and Burma into the Province of Yunnan in China, and while exploration is in no sense complete it probably passes on into the Province of Kwangtung and possibly into Fukien. The tin produced in Siam is shipped out through the Federated Malay States. In Burma it forms a comparatively new industry, where it is also associated with the production of wolfram. An important percentage of this Burma ore is also shipped to the Federated Malay States, the remainder to England. The production of China is largely shipped through Indo-China and Hongkong; at the latter place the trade returns indicate the receipt of 9,188 tons from French Indo-China in 1918 and 8,395 tons in 1919. Practically all of the tin produced in Asia is taken from alluvial deposits, and very commonly the methods employed are very primitive, although in other cases the problem is handled scientifically, as, for instance, at Banca and Billiton, in the Dutch East Indies. In the Federated Malay States 225,862 acres of land have been alienated for mining (1919), most of which is in the hands of Chinese, who produce about 68 per cent of the tin. The following description of this process

(from "British Malaya," by Frank Swettenham, K. C. M. G.) will interest manufacturers of pumping and dredging machinery:

Tin mines in the Malay States are in the enormous majority of cases open workings, because the alluvial deposits are rich and their exploitation is much less expensive and involves less risk than underground and rock mining. The presence of tin is ascertained by boring, by general appearances, and the proximity of existing mines, or by divination and the employment of a Malay "pawang"—in this case a "tin finder" who, working on principles almost identical with those used by "water finders" in England, prospects the surface of the land with a wand and declares that it contains or does not contain tin. The Chinese, the first real miners in the country, have always employed the "pawang" and followed his advice with great confidence, often with the happiest results; but in old days it was usual, especially in shallow ground, to support the "pawang's" opinion by digging pits; nowadays boring is practically universal. When a block of land has been selected and the authority of the land office obtained to work it, a great hole is dug in the ground, the spoil is thrown on one side on worked-out land or wherever permitted by the mining inspectors, and the tin-bearing stratum may be on the actual surface or at depths which vary in different localities from 1 or 2 to 250 feet. The average depth is about 25 inches from the surface. This stratum may be from a few inches to many feet in thickness, and it lies on bedrock consisting of limestone, decomposed granite, schist, or slate, or on beds of clay which in some cases are fine kaolin. In old days it used to be supposed that this kaolin rested on bedrock and that, whether that were so or not, there was no tin beneath it. That theory is now exploded, and a second and even a third layer has often been discovered at some depth below the layer of kaolin.

The tin ore appears mixed with alluvial detritus in various forms—great bowlders and pebbles or, more commonly, fine or coarse, black or white or gray grains, mixed with ordinary sand. Sometimes also tin ore is found mixed with stiff clay, which has to be "puddled" by hand or machinery. The layer containing this "wash dirt" is called "karang" in Malay, and the value of the mine depends upon the thickness and richness of the "karang" and, to some extent, on the depth of the overburden. The Chinese work their mines on a primitive but very effective plan. First, the land is cleared of jungle by Malays or aborigines. Simultaneously the erection of the living houses is commenced. The laying out of the mine and the arrangements for bringing in water for dressing the tin ores and working the water wheel for the Chinese pump next engage the attention of the miner. The Chinese method of bringing in water for the purposes of the mine is simple and economical. The miner may have to make a dam and lead the water by means of a race for some hundreds of yards. He is ignorant of the use of a level, and, dispensing with the services of an engineer, he makes his calculations entirely with his eye, with marvelous accuracy. In laying out the mine due care is taken to provide a suitable site for the washing of the ore and for the continuation of the watercourse at a suitable level as the mine is opened up. The preliminary operations concluded, the work of removing the overburden is commenced. This is done either by laborers on contract, in which case the owner of the mine takes any profit there may be, or by laborers working the land on tribute, in which case the landowner receives only his tribute and is not liable to the laborers if his mine does not turn out to be a financial success. Except in mines worked on tribute, the "karang" or "wash dirt" is generally raised by laborers on wages. The reason for this is that the "karang" does not lie evenly, with richest pockets often occurring in crab holes, or under huge bowlders, the removal of which would not pay the laborer working on contract. As the overburden is removed and the workings are constantly deepened, the bottom of the mine is reached by stepladders made by cutting flat steps, at an acute angle, in the trunk of a tree.

The Chinese run up and down these ladders with bare feet, carrying baskets of spoil slung at either end of a shoulder pole. The mine is kept comparatively dry by one or more endless Chinese lifting pumps, driven by a stream of water working on a small overshot wheel at the surface of the mine. For many years all large mines have been drained by steam pumps. When the "karang" or "wash dirt" is reached, the surface is cleared of overburden and the wash dirt is carried up in baskets and stacked in heaps ready for washing. The washing is done in a coffin-shaped wooden trough, through which a stream of

water is run while one or two skilled coolies standing in the trough rake the "wash dirt" as it is thrown in. The floor of the trough is inclined at a slight angle, and as the "wash dirt" is constantly raked and pushed by the worker's feet to the top end of the trough the heavy ore remains while the sand and pebbles are carried away by the water. The clean ore is then ladled out of the trough, placed in buckets, and carried away to be smelted in charcoal furnaces, or done up in bags and sent to the smelting works of the Straits Trading Co. in Singapore and Province Wellesley. Clean ore of the oxide of tin yields about 70 per cent of pure tin.

The above account was written in 1905, since which time there has been great improvement along lines that will be familiar to those with knowledge of gold operations in California, where, it has been said, the sands were first worked by the white man, who was followed by the Chinese, and he in turn by the dredge. In the Malay Peninsula the Chinese are improving their methods largely through the use of occidental pumping equipment, and dredges are also in use. However, conditions are not very satisfactory. Since 1913 there has been a continued decrease in the production of tin. It has been estimated that in 1917 the production of ore from Chinese-owned mines was 21,771 tons less than in 1913, while the properties under other than Asiatic control had increased 3,610 tons. The figures do not pretend to be accurate but do approximate the facts, and it is realized that the methods must be improved. All concerned also understand that this will involve the expenditure of considerable sums on plant and equipment, and, of course, this is the feature that interests American machinery exporters. So far as the old tin areas are concerned the days of the small mines are passing rapidly. From now on the larger operations by dredge or otherwise will occupy the field, and it is recognized that Americans have much experience in this sort of work and should be able to supply the necessary plant.

COAL AND OTHER MINERALS.

It has been shown in reports covering the neighboring countries of Asia that the fuel problem is difficult. The same general situation applies to the Malay Peninsula. However, there is an important mining property in Selangor, operating under the name of Malayan Collieries (Ltd.), which has shown the following production: 1916, 101,846 long tons; 1917, 155,279 long tons; 1918, 168,740 long tons; 1919, 191,293 long tons. The production of 1918 was distributed as follows: Federated Malay States Railways, 67,437 tons; mines, 66,500 tons; other local consumers, 14,915 tons; exported, 19,888 tons; total, 168,740 tons. The management of these mines aims to raise the production to 400,000 tons per year.

Several other minerals are also mined. The Raub Gold Mines in Pahang produce about 17,000 ounces per year. Tungsten has also been produced in important quantities.

AMOUNTS AND TYPES OF POWER MACHINERY EMPLOYED.

In connection with these data regarding mine properties, manufacturers of power machinery will be interested in the following table, showing the amounts and types of equipment employed; of this total the Raub and the Malayan Collieries use 2,542 horsepower.

Types.	1916	1917	1918
	Horsepower.	*Horsepower.*	*Horsepower.*
Steam	24,810	23,748	27,506
Steam-electric	4,255	2,420	2,427
Hydraulic	17,911	18,524	18,334
Hydroelectric	3,549	4,395	4,512
Suction gas	2,203	1,794	2,219
Oil engines	3,851	2,692	3,171
Oil electric	1,495	2,003	2,153
Total	58,074	55,576	60,322

These data are from the report of the mines department of the Federated Malay States government, which further states that the increase shown in 1918 is mainly due to the reemployment of idle plant. The above data cover the plant in operation rather than merely the plant installed.

Further data regarding the amount of equipment in service are obtainable from the 1918 reports covering the inspection of steam boilers and other machinery, from which the following is abstracted:

Altogether, the total horsepower of plant registered under the machinery enactment was 117,660 horsepower, of which 3,400 horsepower represented water turbines. There were 1,968 steam boilers having a total of 79,817 boiler horsepower. The service on which they were employed was:

Boilers used for—	1916	1917	1918
Mining	1,549	1,515	1,523
Agriculture	135	157	160
General	62	72	71
Government	215	213	214
Total	1,961	1,957	1,968

Most of the above units on tin mining are of the portable type as made in Europe and have noncondensing steam engines. Very commonly the fuel is wood.

Corresponding data for the gas and oil engine installations follows:

Years.	Oil.		Suction gas.	
	Number.	Horsepower.	Number.	Horsepower.
1916	639	15,439	246	13,240
1917	725	17,072	265	14,108
1918	792	19,314	275	15,129

In 1918 these were employed as follows:

Services.	Oil.	Gas.
Mining	281	38
Agriculture	287	195
General	92	23
Government	20	
Presumably idle	112	19
Total	792	275

These figures show that the oil engine is the most popular form of drive, especially for tin mines, except in cases where steam is used, but the popularity of suction gas plants, especially for plantation service, should be noted.

Similar data regarding electrical installations show a total of 11,911 kilowatts of generating capacity and 11,900 horsepower of motors installed. Out of 8,911 kilowatts used for power purposes, 8,634 kilowatts is in mine service, while out of 3,000 kilowatts used for lighting 2,362 kilowatts is for government purposes.

In addition to the above remarks, in which particular emphasis has been placed on the smaller installations (which are, of course, the most numerous), the plants at the Raub mines and the Malayan collieries are really important, as has been shown. There are also 17 bucket dredges at work (with others not far away, but in Siam), the capacity of these being between 2,000 and 4,000 cubic yards per day. One of these dredges has electric drive. It is understood that the other dredges are all steam driven, and a good deal of wood is used for fuel.

MISCELLANEOUS INDUSTRIES.

The above paragraphs have indicated that a certain amount of power equipment has been employed for "general" purposes. Some estimate of the nature of this demand can be gathered from the statistics at the end of this section, although deductions made from these trade returns must allow for machinery shipped to the Straits Settlements that goes to Sumatra, Borneo, Siam, etc., as well as to the Federated Malay States, and also for the fact that imports to the Malay States, while usually shipped via Singapore and Penang and so recorded in the data for the Straits Settlements, may also travel via Port Dickinson, Klang, and Port Swettenham, which are not in the Straits Settlements; these shipments appear in the returns for the Federated Malay States.

At Batu Caves is a cement plant which has shown the following production: 1916, 4,022 tons; 1917, 4,845 tons; 1918, 5,382 tons. All this cement appears to be used locally, none being exported. On the other hand, this plant does not fully supply the local demand, the imports into the Federated Malay States being: 1915, 70,114 casks; 1916, 62,867 casks; 1917, 58,223 casks; 1918, 45,880 casks; 1919, 78,317 casks.

This situation has encouraged a group of Chinese to install a large modern cement plant on the outskirts of Singapore which is equipped with rotary kilns and American machinery throughout and was expected to start production some time in 1921.

Scattered through the territory are a number of factories producing tapioca. There is a certain demand for machines to extract vegetable oils. Most of these handle copra, but there is also some call for machinery to handle the products of the African oil palm, which seems to require rather different equipment. There is at least one sawmill in service, this being equipped with American machinery. The dockyards at Singapore, the repair shops at other points, and the railway shops, of course, require the usual equipment.

In connection with discussions regarding the trade of Asia, writers and speakers often emphasize the possibilities of China, but it is in the Malay Peninsula that the Chinese are seen at their best. They con-

stitute about 42 per cent of the population of the Federated Malay States and a much larger fraction of the population of the Straits Settlements, and to them belongs a large share of the credit for the rapid development of the territory. Manufacturers interested in estimating the future possibilities of China should observe closely the progress made here. Some of these Chinese are very wealthy and apparently very influential. They manifest a progressive and patriotic spirit and have the confidence and respect of the European as well as the Asiatic community. Apparently they are prepared to establish industries as favorable opportunities develop.

CHARACTER AND POSSIBILITIES OF THE MARKET.

As has been stated, the machinery markets for the Malay Peninsula are at Singapore, Penang, Kuala Lumpur, Ipoh, and some lesser points, and their comparative importance is in the order in which they have been named. In each of these cities there are merchants specializing in machinery, but most of the offices at Penang, Kuala Lumpur, and Ipoh are branches of Singapore firms and usually the manager for the district has his office in Singapore. For this reason it is apparent that the machinery business in this territory is controlled from Singapore, which is also the most important point, as the trade returns show that the larger part of the machinery is imported through that city. But, although this is the case, most of the machinery is "sold upcountry," the different Singapore firms having their engineering department at one of the upcountry cities already mentioned.

Singapore, the center of this trade, is a clean, healthy city, 90 miles from the Equator, with a humid atmosphere, temperatures between 70° and 95° F., and plenty of rain. The total population (1911) was 259,610, of whom about 4,000 were Europeans; but as the city is the capital of the colony and a naval base there is a large official community, and the commercial population is smaller than might be expected. The island on which the city stands is 27 miles long and 14 miles wide; this British territory is separated from the native State of Johore by a narrow strait. The machinery business of Singapore is handled by about 15 or 20 merchants, almost all of whom are British, and most American manufacturers of machinery will find it necessary to cultivate this territory through them. In this connection it should be remembered that all of these merchants do not cultivate the same territory, for while some pay most attention to business in the Malay Peninsula, others are interested in Borneo or Sumatra, but the entire territory is developing very rapidly. A list of these firms is on file in the Bureau of Foreign and Domestic Commerce.

The settlement next in importance is Penang, also an island, about 500 miles from Singapore at the other end of the Straits of Malacca, close to the west coast of the peninsula. The port and city are legally known as Georgetown, but this name is now seldom used in commercial correspondence, the word Penang being used for addressing letters, cables, and shipments to the city. The population of Penang in 1911 was 101,182. The American population of the entire Straits Settlements in 1911 was 62, including missionaries.

Malacca is another port in the Straits Settlements with a considerable history, but it has sunk quite low in commercial importance, importing almost no machinery.

The comparative value of the machinery imports into these cities is shown by the returns as issued by the authorities of the government of the Straits Settlements, values being given in Straits Settlements dollars (worth about 56 American cents). The last year for which these segregated figures are available is 1920:

Classes.	Singapore.	Penang.	Malacca.	Total.
	Straits dollars.	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*
Electrical machinery	1,887,946	178,480	7,200	2,073,626
Engines, boilers, and parts	1,426,749	803,559	4,740	2,235,048
Other machinery	5,479,596	181,541	66,489	5,727,626
Total	8,794,291	1,163,580	78,429	10,036,300

For other years the total imports at all of the above cities were:

Classes.	1913	1914	1915	1916	1919
	Straits dollars.	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*
Electrical machinery	635,106	436,269	340,200	378,888	1,316,486
Engines, boilers, and parts	1,106,647	800,138	511,053	967,733	1,387,123
Other machinery	1,479,380	1,188,304	862,158	1,396,159	2,905,328
Total	3,221,133	2,424,711	1,713,411	2,742,780	5,608,937

About 65 per cent of this machinery goes to the Federated Malay States. At the end of this section are further details indicating the countries of origin from which this machinery was shipped.

English is the commercial language of this territory, and is used for business purposes even in dealing with the Chinese, for there are about 10 different Chinese dialects used in the colony. On the other hand, in dealing with labor one may be called upon to use either Malay, Tamil, or Chinese, but these languages are not needed in commerce; these people buy very little, or, if they reach a position where they can become purchasers, they have also acquired English.

Machinery enters both the Straits Settlements and the Federated Malay States free of duty, and there is no discrimination against American products, except, as is always the case, when Europeans need to learn to appreciate American goods.

Steam boilers, gas holders, gas generators, and electrical installations must pass inspection and receive the approval of the Government authorities before being placed in service, and manufacturers should be certain that equipment will comply with the rules before they export it.

The more carefully one analyzes this market the more strongly the impression develops that the United States can increase its share in this business, as that share was only 20.4 per cent in 1917. American electrical and power machinery is well suited to the needs of this district, and the United States absorbs more of the exports from this territory than any other country, taking about 35 per cent. One gathers the impression on visiting the country that Americans have

made only a very small effort to introduce their machinery in this market, but the territory is developing very rapidly and, within the limitations of the market, as suggested above, deserves very careful attention. Care should be exercised to secure adequate representation in Sumatra, Borneo, and Siam, as well as in the Malay Peninsula itself.

Purchases for the various government departments are made through the Crown agent in London (England), while the requirements for the municipalities of Singapore and Penang are purchased by Lindsay & Pierce, municipal agents, 180 Hope Street, Glasgow, Scotland.

CURRENCY, WEIGHTS, AND MEASURES.

The Straits Settlements dollar contains 312 grains of silver, but is practically a token coin, normally worth 28½ pence, or $0.5678 United States currency, though the exchange fluctuates seriously.

The following is a statement of equivalents for weights and measures commonly employed:

ORDINARY WEIGHTS.

1 tahil=1⅓ ounces avoirdupois.
16 tahil=1 kati=1⅓ pounds avoirdupois.
100 kati=1 pikul=133⅓ pounds avoirdupois.
3 pikul=1 bhara=400 pounds avoirdupois.
40 pikul=1 koyan=5,333⅓ pounds avoirdupois.

GOLDSMITHS' WEIGHTS.

12 sava=1 mayam=52 grains.
16 mayam=1 bongkal=832 grains (2 Spanish dollars).
12 bongkal=1 kati=9,984 grains (1 pound 8 ounces 16 pennyweight).

OPIUM WEIGHT.

10 tee=1 hoon.
10 hoon=1 chee.
10 chee=1 tahil.

MEASURES OF CAPACITY.

2 gills=1 pau or quarter chupak.
2 pau=1 pint or half chupak.
2 pints or 4 pau=1 quart or chupak.
4 quarts or chupak=1 gallon or gantang.
10 gantangs=1 para.
800 gantangs=1 kayan.

DETAILED STATISTICS OF MACHINERY TRADE.

The table below shows imports of three classes of machinery into the Straits Settlements, according to the customs returns of the colony:

ELECTRICAL MACHINERY.

Countries of origin.	1913	1915	1918	1920
	Straits dollars.	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*
United Kingdom	490,705	263,958	145,961	1,055,339
Germany	81,207	1,900		
British India and Burma	12,999	9,845	1,620	

ELECTRICAL MACHINERY—Continued.

Countries of origin.	1913	1915	1918	1920
	Straits dollars.	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*
Hongkong		5,975	14,472	66,997
Federated Malay States	3,495	1,610	5,920	9,732
Non-Federated Malay States	195	1,014	6,920	2,515
Canada				217,700
Australia			6,791	8,783
Belgium	1,147			4,800
Denmark	8,341	3,525		40,950
France	200		6,000	15,200
Italy	5,569	6,581	8,000	49,074
Netherlands	1,155	17,092		74,362
Netherlands East Indies	520	3,250	4,091	9,367
Japan	7,095	7,980	118,339	102,542
United States	6,749	13,188	78,678	402,735
Other countries	14,849	4,282	[1] 76,260	13,470
Total	634,226	340,200	473,052	2,073,626

ENGINES, BOILERS, AND PARTS.

	1913	1915	1918	1920
	Straits dollars.	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*
United Kingdom	925,104	432,319	325,857	1,792,703
British India and Burma	5,215		2,720	
Hongkong	5,000	16,651	20,149	11,952
Federated Malay States	14,720	3,314	19,108	45,180
Non-Federated Malay States	328	2,615	8,550	
Australia	750	33,000	319,175	6,311
Belgium	61,082			4,000
Denmark		4,700	12,750	
Germany	24,094			
Netherlands	23,620	4,900		
Netherlands East Indies	1,360	900	700	7,722
Japan	516	1,200	80,800	33,470
Siam and Siamese States			14,970	52,665
United States	35,948	7,812	114,727	266,670
Other countries	8,910	3,642	[2] 77,130	14,375
Total	1,106,647	511,053	996,636	2,235,048

UNENUMERATED MACHINERY.

	1913	1915	1918	1920
	Straits dollars.	*Straits dollars.*	*Straits dollars.*	*Straits dollars.*
United Kingdom	1,095,113	608,131	661,712	2,987,971
British India and Burma	7,847	8,260	28,855	23,142
Ceylon	4,822		30,200	6,310
Hongkong	2,561	14,285	39,566	9,293
Federated Malay States	52,369	45,171	146,270	103,763
Non-Federated Malay States	3,167	8,828	12,668	29,798
Canada			12,284	3,000
Australia	20,740	35,676	128,227	220,780
Belgium	20,100			5,400
Denmark	6,223	7,603	1,214	70,925
France	10,645	1,025		10,695
Germany	69,157			46,595
Italy	5,130			7,841
Netherlands	6,983			26,100
China	1,015	1,985	1,445	14,321
French Indo-China	340		1,450	43,500
Japan	2,150	9,654	116,663	61,071
Siam and Siamese States	2,602	3,200	10,800	6,150
Netherlands East Indies	9,514	25,228	48,603	86,640
United States	132,592	83,036	403,886	1,928,775
Other countries	3,665	10,076	17,929	35,557
Total	1,456,735	862,158	1,661,772	5,727,626

[1] Includes China, S. $65,789.

[2] Brazil.

American customs returns give the following figures for exports of machinery to the Straits Settlements:

Classes.	1910[1]		1913[1]		1915[1]	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Stationary gas engines					3	337
Gasoline engines:						
Automobile			1	197		
Marine			43	7,113	52	3,552
Traction					1	3,000
Steam engines:						
Marine					1	166
Stationary	33	4,409				
All other engines			3	773	1	120
All other parts of engines		1,388		555		1,355
Flour and grist mill machinery					292	2,008
Metal-working machinery		1,044		14,638		3,514
Oil-well machinery						30,309
Other mining machinery		9,476		57,267		22,606
Pumps and pumping machinery		4,643		8,431		10,458
Refrigerating, including ice-making machinery				5,786		
Sawmill machinery						6,563
Other woodworking machinery				561		
All other machinery and parts of		16,695		18,058		14,628
Total		37,655		113,671		98,616

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		13,992		5,339		2,612
Concrete mixers				3,400		2,274
Elevators and elevator machinery		3,497		662		
Electric locomotives	1	2,100				
Stationary gas engines	30	9,999	7	760	6	941
Gasoline engines:						
Automobile	11	4,600	7	4,170		
Marine	34	16,175	144	51,613	29	12,661
Stationary	7	1,221	109	23,532	2	11,320
Traction	32	26,818	145	207,281	38	46,849
Kerosene engines	15	8,821	19	9,989	19	1,884
Steam engines:						
Locomotives	13	372,600			20	496,000
Marine	4	118,000				
Stationary			5	17,057		
Traction			16	29,724		
All other engines	46	124,077	57	16,328	1	100
Boilers		155		23,374		36,400
All other parts of engines		56,722		110,516		46,171
Excavating machinery		162		64,709		44,693
Flour and grist mill machinery		100		48		70
Power laundry machinery						111
Lathes		5,156		19,151		1,649
Other machine tools		12,498		28,254		16,327
Sharpening and grinding machines		860		1,524		2,691
All other metal-working machinery		10,656		4,491		7,148
Oil-well machinery		39,800		92,337		183,189
Other mining machinery		14,800		80,338		158,311
Paper and pulp mill machinery		4,701				
Pumps and pumping machinery		32,246		54,622		54,224
Refrigerating, including ice-making machinery		9,567		11,721		2,834
Road-making machinery				2,625		
Textile machinery		286		978		1,268
Sawmill machinery		9,931		8,124		2,820
Other woodworking machinery		16,343		16,521		103
All other machinery and parts of		476,789		330,275		119,769
Total		1,392,672		1,219,463		1,252,419

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.

Exports from the United Kingdom to the Straits Settlements and to the Federated Malay States are shown below.

TO STRAITS SETTLEMENTS.

Classes.	1914	1915	1916	1917	1918
Locomotives	£1,579	£797	£1,142	£203	£7,186
Internal-combustion engines	....	32,816	41,942	18,433	11,624
Unenumerated prime movers	125,534	5,729	7,743	3,469	6,519
Electrical machinery	25,027	....	....	....	....
Electric motors and generators	....	16,558	6,557	10,530	4,044
Unenumerated electrical machinery	....	8,443	6,606	3,896	1,498
Mining machinery	11,031	10,769	20,493	19,974	30,243
All other	201,346	106,423	147,498	136,515	99,470
Total[1]	364,517	181,535	231,981	193,020	160,584

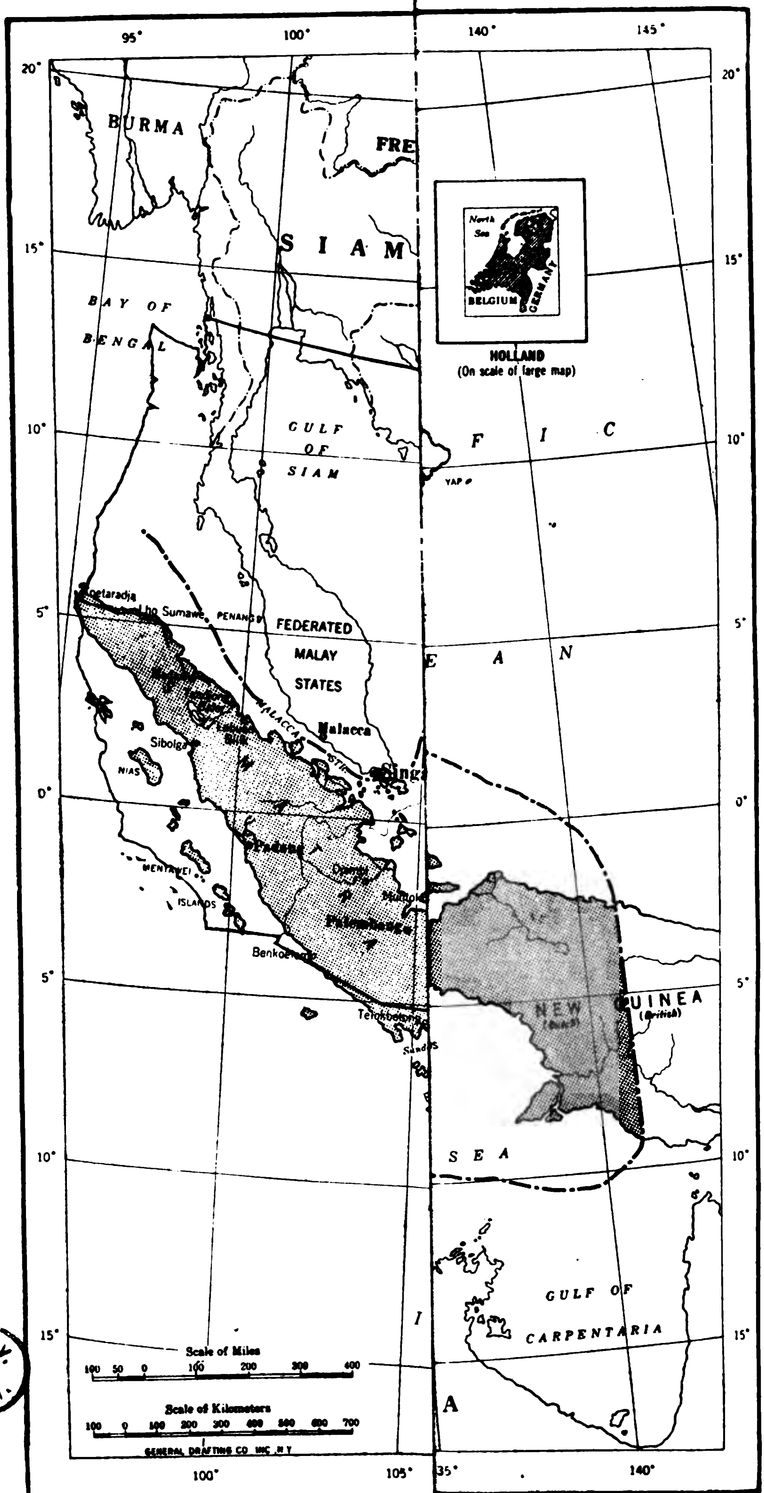
[1] The total for 1919 is £373,406 and for 1920 it is £830,314. A change in classification makes it impracticable to show separate items.

TO FEDERATED MALAY STATES.

Classes.	1914	1915	1916	1917	1918	1919	1920
Locomotives	£40,857	£5,868	£13,100	£17,572	£2,024	£2,186	£168,000
Electrical machinery	....	16,211	1,064	3,192	891	....	....
Other	48,228	46,129	28,686	27,120	18,603	37,438	133,491

Below is a statement of machinery exports to the Straits Settlements from Japan:

Classes.	1915	1916	1917	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Electrical machinery	6,016	13,659	27,353	53,207	35,000	52,000
Telephones	2,606	276	1,089	591	1,000	1,000
Textile machinery	12,352	....	10,614	5,023	....	1,000
Lathes	....	....	19,700	36,473	45,000	3,000
Printing machinery	2,991	5,443	8,649	22,277	9,000	6,000
Other machinery	23,521	31,231	84,525	429,369	91,000	61,000
Total	47,486	50,609	151,930	546,940	181,000	124,000


BURMA
SIAM
FRE
BAY OF BENGAL
GULF OF SIAM
FEDERATED MALAY STATES
Penang
Malacca
Sibolga
Padang
Palembang
Benkoelen
Telokbetong
NIAS
MENTAWEI ISLANDS
YAP
F I C
E A N
NEW GUINEA (British)
S E A
GULF OF CARPENTARIA
I A
North Sea
BELGIUM
GERMANY
HOLLAND
(On scale of large map)
Scale of Miles
100 50 0 100 200 300 400
Scale of Kilometers
100 0 100 200 300 400 500 600 700
GENERAL DRAFTING CO. INC. N.Y.

NETHERLANDS EAST INDIES.

EXTENT AND GENERAL CHARACTERISTICS OF THE MARKET.

In studying this territory one finds a situation different from any existing elsewhere in Asia, for the industries in the Netherlands East Indies are much older than those in other Asiatic countries. Sugar is the outstanding product of Java, and as long ago as 1894 the area planted was about 300,000 acres and the yield 2.81 tons of sugar per acre. The mere fact that such figures exist demonstrates that some good scientific work was in hand as far back as the Japan-China war and the days when American influence was first being felt in the Philippines. The cotton-spinning industry was then very young in Japan and had not developed very far in India. The first Government railway in Java was opened to the public as long ago as 1878. Consequently the mechanical era in Java goes well back into the nineteenth century, and the returns showing the imports of machinery have a correspondingly different significance from those applying to the other countries that have been opened up more recently.

Also, in those nineteenth-century days we had very little contact with engineering in the Netherlands or that in the East Indies, with the result that one sees almost no trace of American influence in the engineering works that have been built in Java. This is undoubtedly unfortunate for Java, as the world in general recognizes the superior qualities of American engineering and one gathers the impression that these works might be greatly improved. However, during the war large quantities of American machinery were imported into the Netherlands East Indies, and with this introduction it is to be hoped that American methods and designs will hereafter be appreciated and adopted.

IMPORTS OF ALL COMMODITIES BY COUNTRIES OF ORIGIN.

It is difficult to present a concise statistical statement illustrating the possibilities of this market, but it will help a little to consider first the total volume of the imports of all commodities into the whole archipelago, noting the percentage supplied by the different countries. This is shown below:

[Values expressed in thousands of guilders.]

Countries.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Netherlands	96,449	109,793	129,879	145,259	124,070	99,902	90,771	47,947	11,355	83,359
Great Britain	40,628	55,349	63,561	76,571	70,311	79,922	84,651	70,807	78,630	90,860
Germany	12,492	16,145	20,665	28,776	21,759	4,302	842	361	477	957
United States	5,200	5,561	7,203	9,033	9,693	15,058	30,801	60,592	62,440	130,487
British India	35,020	43,276	37,276	22,746	15,153	16,235	27,136	30,923	32,791	16,205
Singapore	62,761	66,611	60,555	67,847	58,923	66,087	76,507	119,187	134,113	132,191
Japan	3,139	3,731	4,901	6,769	6,591	12,810	27,238	54,879	114,580	77,075
Others	59,269	58,498	55,103	79,682	76,650	78,002	64,849	80,068	94,569	106,922
Total	314,958	358,964	379,143	436,683	383,150	372,318	402,795	464,764	528,955	638,056

NOTE.—The par value of the guilder is 40.2 cents. More recent returns than those given above are not yet available.

It will be observed that before the war about one-third of all the imports were from the Netherlands. If shipments via Singapore are credited to Great Britain another third was from the United Kingdom. Germany does not occupy a very important position, but this again raises the question of transshipment, for German goods shipped via ports in the Netherlands, Great Britain, or the Far East would be credited to the last port of shipment. German participation in this trade was probably larger than these figures indicate. During this pre-war period shipments direct from the United States did not exceed 2 per cent of the total. It is not possible to estimate what volume might have been transshipped, but the impression one receives in Java is that the United States did almost no machinery business with the Netherlands East Indies up to 1914.

The war had a marked influence on this trade. German goods disappeared. British direct trade was well sustained if measured in money values but probably fell off considerably if measured in tons; British goods via Singapore probably did not decrease. Direct shipments from the United States and Japan increased rapidly, but it will be noted that the American share during the war never exceeded 13 per cent. Experience since the armistice is self-explanatory except that one should remember that in 1919 Java had a "seller's market" and American goods were among those that could be obtained.

The relatively small extent of American influence in the total import trade of the archipelago suggests that, as a people, we have been neglecting a very good market. The above figures do not present a very clear view of the American position in the machinery trade, but that will appear hereafter. It is apparent that American business in the East Indies needs to be put upon a better basis.

CLASSIFICATION COVERING INDUSTRIAL MACHINERY.

In employing the import returns published by the government of the Netherlands East Indies, a question arises as to the classifications that really cover industrial machinery. Such parts of the returns as seem related to this subject are reproduced in the table below, and in presenting these figures an effort has been made to translate carefully the different headings. Unfortunately, it is never possible to do this perfectly, as Americans do not ordinarily give these words the exact meaning conveyed by the original. But it appears that our interest is confined to the first two classifications, as the investigation represented by this report did not include the market for sewing machines, hand tools, or agricultural implements. There is some possibility that the third and sixth items might include some machinery, but these classifications were not employed prior to 1915. The imports into Java and Madura have been as follows:

Classes.	1911	1912	1913	1914	1915	1918	1919	1920
	Guilders.[1]	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*
Power generating machinery[2]	9,994,991	13,845,151	19,128,807	14,058,844	3,201,834	2,727,098	11,475,212	14,524,921
Machines for sugar factories	4,813,079	5,749,459	5,780,205	4,015,463	3,124,191	987,000	4,683,343	5,320,839
Mechanical apparatus not elsewhere specified	....	....	....	....	1,236,150	2,636,153	6,928,343	5,926,638

[1] The guilder has a par value of 40.2 cents.
[2] "Factory and steam machinery" through 1914.

Classes.	1911	1912	1913	1914	1915	1918	1919	1920
	Guilders.	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*
Sewing machines	678,328	1,498,784	1,091,104	744,492	994,590	1,301,865	1,892,250	2,193,534
Agricultural tools					1,220,112	1,300,055	1,933,155	3,443,471
Hand tools and professional instruments					807,105	910,635	2,969,263	5,371,917
Other machinery and tools, not elsewhere specified					2,203,959	3,577,719	10,052,633	15,204,704

In addition to the information given in the above table some further particulars regarding this trade can be derived from the detailed statements published by the Governments of the United Kingdom, Japan, and the United States, as given in the tables beginning on page 205. The classifications in those statements are in greater detail than the above.

RAPID INCREASE IN AMERICAN TRADE AT EXPENSE OF COMPETITORS.

The *total* exports of industrial machinery from the United States to the Netherlands East Indies have been as follows, according to returns of the United States customs: 1910, $84,448; 1913, $424,314; 1915, $212,630; 1918, $2,171,062; 1919, $4,546,249; 1920, $3,962,705; 1921, $5,061,080.

As can be seen by comparison with the table above, the rapid increase in the volume of our machinery shipments to the Netherlands Indies does not represent any particular development of the industries in the Far Eastern archipelago. There has long been a substantial commerce of this sort with Europe, and, as war deprived these buyers of their usual sources of supply, a corresponding increase developed in the demand for American machinery. This is also illustrated by the following values taken from the returns published by the British Government, corresponding to the American experience just described; the figures show the total exports of industrial machinery from the United Kingdom to the Netherlands East Indies (converted at the par value of $4.8665 to the pound): 1911, $1,106,472; 1912, $1,649,135; 1913, $1,669,925; 1914, $1,725,422; 1915, $920,825; 1916, $1,361,939; 1917, $1,086,821; 1918, $530,867 (see footnote to table on p. 206). For the first three years the figures are for Java only.

ANALYSIS OF NETHERLANDS INDIES FIGURES.

The figures presented in the above statement give a rough idea of the demand for machinery in these islands and the way it has been sustained since the beginning of the century. The demand for machinery there is not new but is a well-established trade. These figures also show how the British have long supplied an important volume of such equipment to these buyers and how the American participation is a comparatively new development. These same facts are shown more clearly by the returns of the customs of the Netherlands East Indies as taken from a section different from that employed in preparing the above tables, but constituting a detailed

statement of the imports from each country and usually including two items relating to industrial machinery. These returns are presented in the tables below; it will be noted that they do not check with the returns given above but apparently include all classes of imports as represented by the items in the table on pages 180 and 181, and therefore include hand tools, sewing machines, agricultural tools, and a number of other classes of equipment not covered by the writer's investigation. Also, electrical equipment is commonly included in the figures of the first table below, thereby establishing a total greater than shown by the table on page 179. On the other hand, the classification "Machinery for sugar factories" appears to refer to machinery and supplies used in connection with sugar "centrals" and it will be remembered that, although this is the most important industry in the whole archipelago, it is all concentrated in the eastern part of Java.

ORIGIN OF MACHINERY IMPORTS INTO NETHERLANDS EAST INDIES.

[Values expressed in thousands of guilders.]

Years.	Netherlands.		Great Britain.		Germany.		United States.		Japan.	
	For sugar factories.	Other.[1]	For sugar factories.	Other.[1]	For sugar factories.	Other.[1]	For sugar factories.	Other.[1]	For sugar factories.	Other.[1]
1900	2,876	4,664	1,012	1,231	....	175	4	46	....	....
1901	3,279	3,416	462	1,025	4	188	1	186	....	....
1902	1,553	3,433	163	606	12	355	13	60	....	....
1903	938	2,502	143	684	37	291	2	46	....	....
1904	1,821	3,267	264	700	39	327	10	86	....	....
1905	3,802	4,634	455	1,074	194	298	3	121	....	....
1906	2,700	4,792	527	740	440	651	11	103	....	....
1907	2,334	5,534	523	1,238	668	730	14	111	....	....
1908	3,646	8,232	844	1,727	287	1,023	3	113	....	....
1909	3,326	5,473	608	1,006	365	821	1	91	....	....
1910	2,931	7,423	797	1,237	515	1,316	4	208	....	....
1911	3,457	9,107	869	2,322	440	2,181	7	257	....	....
1912	3,371	12,032	1,660	3,792	675	3,085	21	284	....	....
1913	3,590	16,881	1,178	3,388	827	4,668	1	508	....	7
1914	2,572	11,999	709	4,200	630	2,728	7	727	....	....
1915	2,650	7,944	373	2,511	24	533	21	924	....	310
1916	3,191	7,927	563	3,339	1	66	272	2,628	....	350
1917	1,791	5,473	643	3,135	....	18	390	5,765	....	1,616
1918	235	1,848	287	1,765	....	19	363	5,545	....	3,158
1919	3,180	17,190	633	5,608	5	287	705	19,224	....	1,231
1920	3,904	....	878	....	304	....	216	....	3	....

[1] Includes electrical equipment.

TOTAL IMPORTS OF MACHINERY FOR SUGAR FACTORIES INTO NETHERLANDS EAST INDIES.

[Values expressed in thousands of guilders.]

Years.	Total value.	Percentage from—			
		Netherlands.	Great Britain.	Germany.	United States.
1900	3,892	74.0	25.9	....	0.1
1901	3,746	87.7	12.3	....	....
1902	1,741	89.2	9.4	0.7	.7
1903	1,120	83.7	12.8	3.3	.2
1904	2,134	85.4	12.1	2.0	.5
1905	4,454	85.5	10.2	4.2	.1

TOTAL IMPORTS OF MACHINERY FOR SUGAR FACTORIES INTO NETHERLANDS EAST INDIES—Continued.

Years.	Total value.	Percentage from— Netherlands.	Great Britain.	Germany.	United States.
1906	3,691	73.6	14.2	11.9	.3
1907	3,562	66.2	14.7	18.7	.4
1908	4,815	76.4	17.5	6.0	.1
1909	4,312	77.3	14.2	8.5	....
1910	4,290	69.3	18.6	12.0	.1
1911	4,813	72.4	18.4	9.1	.1
1912	5,749	58.7	28.9	11.7	.4
1913	5,780	62.2	20.4	14.3	....
1914	4,015	64.1	17.5	15.7	.2
1915	3,124	84.6	11.9	.8	.7
1916	4,027	79.1	13.9	.3	6.7
1917	2,824	63.5	22.4	....	13.8
1918	987	23.8	29.1	....	36.8
1919	4,683	68.0	13.5	.1	15.0
1920	5,321	73.4	16.5	5.7	4.1

NOTE.—The above are only approximately correct.

The conclusions to be drawn from these figures regarding the sugar-machinery trade require no explanation, but it should be emphasized here that they do not express the price or engineering merit of American sugar machinery. The best sugar mills in Formosa, the Philippines, Hawaii, and Cuba are all equipped with American machinery, and these mills are far superior to those found in many other sugar-producing countries. The placing of American equipment in the sugar centrals of Java is a very nice sales problem, but will bring good returns to the successful manufacturer, because there are nearly 200 of these mills there, and many of them are now old if not obsolete, and maintenance if not replacement will necessitate very large purchases. During the war the importations of sugar-mill machinery fell below the pre-war level by many millions of guilders. If expressed in terms of weight instead of money, the deficiency would be found to be much greater. This deficiency should now be made up. But the potential business is far above the level these figures indicate, because they do not allow for any growth or development.

Corresponding to the table last given, which shows how the sugar-machinery business was distributed among the different countries of origin, the table on page 184 shows how the other machinery trade of the whole archipelago was distributed. These figures include tools as well as machinery, and consequently are a litttle deceptive, but difficulties of this sort can be overcome at least in part by making comparisons with the figures published in the section beginning on page 205. From page 184 one learns that by 1919 our machinery sales to these islands had expended some 3,800 per cent since 1913 and the United States had supplied more machinery than any other country. At first one is tempted to assume that Americans will now hold a position of preeminence in this business. But unfortunately the indications are that Americans will not be able to hold this position unless great improvement is made in the sales methods employed there. The tables given above and below are very interesting in that they show the rise and fall of German participation in the machinery

trade of these islands. If it be contended that these figures do not really represent the total German participation in this business because of shipments via ports in the Netherlands, it will be noted that these have collapsed also. Similarly Japan has gone into and out of this trade. In contrast it will be noted that the British participation has been remarkably uniform and consistent, like that of the Netherlands. The following table shows the total imports of "machines and tools, including electrical apparatus" (but excluding machinery for sugar factories), into the Netherlands East Indies:

[Values expressed in thousands of guilders.]

Years.	Total value.	Percentage from—				
		Netherlands.	Great Britain.	Germany.	United States.	Japan.
1900	11,305	41.3	10.9	1.5	0.4	....
1901	9,819	34.8	10.4	1.9	1.9	....
1902	7,255	47.3	8.3	4.9	.8	....
1903	5,497	45.5	12.4	5.3	.8	....
1904	7,558	43.2	9.2	4.3	1.1	....
1905	11,457	40.4	9.4	2.6	1.1	....
1906	11,323	42.3	6.5	5.8	.9	....
1907	12,352	44.8	10.0	5.9	.9	....
1908	16,980	48.5	10.2	6.0	.7	....
1909	12,527	43.7	8.0	6.5	.7	....
1910	15,627	47.5	7.9	8.4	1.5	....
1911	20,039	45.5	11.6	10.9	1.3	....
1912	26,412	45.5	14.4	11.7	1.1	....
1913	32,883	51.3	10.3	14.2	1.5	....
1914	25,133	47.9	16.7	10.9	2.9	....
1915	16,079	49.4	15.6	3.3	5.8	1.9
1916	19,940	39.7	16.7	.3	13.1	1.8
1917	20,974	26.1	15.0	.1	27.6	7.7
1918	17,448	10.6	10.1	.1	31.8	18.1
1919	55,648	30.9	10.1	.5	34.5	2.2

NOTE.—The above are believed to be correct for the first three figures but may not be accurate beyond.

But the above table does not tell the complete story of this machinery trade because it disregards the "machinery" imported via Hongkong, Singapore, and Penang, which is credited to those ports and not to the country of origin. For the sake of completeness these returns are shown in the table below, which indicates that this transshipment trade has developed to a volume of more than $1,-500,000 per year, mostly via Singapore and, therefore, probably mostly British. Probably it would not introduce serious error if the total of these shipments were credited to British sources, and this in turn suggests that the British have always had a stronger influence in this market than any other nation except the Netherlands and that their trade has been most regular. It is also worth noting that probably very little of the business represented by the following table is industrial machinery in the usual sense because these heavy shipments usually go direct. Shipments from Hongkong and Singapore would commonly go to Borneo, Java, and islands farther east, while practically all of the shipments from Penang would be sent to Sumatra.

[Values expressed in thousands of guilders.]

Years.	Imports of "Machines and tools" to Netherlands East Indies via—				Per cent of total like imports.
	Hongkong.	Singapore.	Penang.	Total.	
1900	2	710	189	901	8.0
1901	5	721	178	904	9.2
1902	3	846	110	959	13.2
1903	3	625	155	783	14.2
1904	5	852	120	977	13.0
1905	4	679	107	790	6.9
1906	5	821	371	1,197	10.5
1907	10	882	162	1,054	8.5
1908	23	528	130	681	4.0
1909	43	393	121	557	4.4
1910	16	673	109	798	5.1
1911	17	812	235	1,064	5.3
1912	40	785	163	988	3.7
1913	64	913	128	1,105	3.4
1914	31	648	130	809	3.2
1915	46	334	60	440	2.7
1916	26	1,020	80	1,126	5.7
1917	58	1,176	115	1,349	6.4
1918	41	2,075	114	2,230	12.8
1919	108	3,525	181	3,814	6.7

The above series of tables constitute a rather involved statement but are presented as the best description of the conditions existing in this market that the writer has been able to secure. It is felt that from them one can derive an accurate impression of the general position of American machinery in these islands and the unusual experience since 1914 resulting from war conditions. Also, possibly one can project these curves into the future and make plans for the protection and development of his business. At the same time it is realized that the above statements deal with the total of all machinery and provide very little information regarding particular kinds of machinery. Such analysis can only be made from the detailed tables beginning on page 205, but very interesting information can be derived in this way. For example, American exports of internal-combustion engines and metal-working machinery to the Netherlands East Indies have been as follows:

Years.	Internal-combustion engines.		Value of metal-working machinery.
	Number.	Value.	
1913	27	$4,403	$6,366
1914	24	4,033	20,216
1915	18	19,417	9,229
1916	31	16,888	56,281
1917	189	70,954	245,594
1918	200	199,754	260,788
1919	429	289,113	614,498
1920	458	476,721	326,086
1921	337	284,430	361,296

In considering all of the above statistics one should constantly make due allowance for the effects of the war, not forgetting how very difficult it was to secure machine tools or machinery of any kind during 1917 and 1918, when practically all of the important producing countries placed embargoes upon the export of such equip-

ment; even when the necessary machines were obtained, there followed a long list of additional permits and priority orders to contend with, especially when the equipment was destined for such a market as this.

The conclusion one reaches from the above tables, like the one obtained in Java, is that before the war this market drew its machinery and supplies from European sources, and American equipment was practically unknown. It had never been represented in this market. It was not a case of comparative merit or price, but of a neglected market. British, German, and other manufacturers were well represented and had worked the market well. They had supplied vast quantities of equipment for the sugar mills, railways, mines, plantations, and other enterprises, but there had been no American salesmanship in the archipelago, although it is a very large territory, with a large population that is well governed and occupies possibly the most attractive territory on earth—a veritable paradise.

As for the future, the American manufacturer and exporter of machinery will find that his problem in this territory is to develop his business in a market which has long been established and occupied by others and in which he is not known; a market where the ideas and ideals have been derived from continental Europe, although considerably influenced by the British, but where American machinery, American methods, American finish, American standardization, and American ways of conducting business are not appreciated even if known, and where much of the so-called "information" on these subjects that is in circulation is in reality misinformation.

This archipelago is an interesting field that is receiving the attention of certain of our business men, and deserves the attention of others. American automobiles, cash registers, typewriters, and certain other lines of American machinery are becoming well known and highly appreciated. The Dutch, in both public and private enterprises, have found that frequently they can buy mechanical equipment in America to better advantage than in Europe. A number of the machinery dealers of Java have opened offices in the United States, and the colonial department of the Netherlands Government has opened a purchasing branch in New York. As a result, these offices have purchased many millions of dollars' worth of equipment for the archipelago. American machinery is now at work in connection with a great variety of enterprises in these islands—in the mines, the oil mills, the sugar mills, the petroleum fields, etc. American locomotives now operate on their railways and have been found so satisfactory as to be placed on the runs that involve the most severe service—with the best of results. American machine tools have established a splendid reputation for themselves there. Of the recent imports of automobiles, more than 90 per cent are of American make. This wonderful group of islands constitutes a most desirable market, which Americans can develop with good results, but they constitute a sales problem of some difficulty and will ordinarily be found to require careful study.

GOVERNMENT IMPORTS.

In all of the above Dutch statistics only private imports have been shown, but the Netherlands East Indian Government is the most

important individual purchaser of machinery in the archipelago. The following table shows the volume and sources of the government imports of machinery for the year 1920:

Machinery.	United States.	Netherlands.	Great Britain.	Total from all countries.[1]
	Guilders.	*Guilders.*	*Guilders.*	*Guilders.*
Locomotives	1,298,480	1,431,673	4,475	2,736,228
"Locomobiles" (a form of power plant)	....	9,000	283	49,283
Gas engines	41,000	61,390	4,200	106,500
Electrically-driven equipment	49,802	24,000	....	76,502
Other electrical equipment	217,050	317,702	....	541,032
Other power-driven equipment	36,722	12,243	300	51,165
Textile machinery	....	12,604	....	18,604
Mechanical tools	27,108	122,553	5,000	167,561
Agricultural tools	10,687	11,815	....	22,502
Hand and professional tools	55,662	181,136	1,450	238,932
All other kinds	246,844	714,519	81,495	1,046,864
Total	1,983,355	2,898,635	97,203	5,055,173
Per cent	39.2	57.3	1.9	....

[1] Imports from Italy, Germany, France, Japan, etc., were not large and are not shown separately. Their volume can be estimated from these totals.

EXTENT OF TERRITORY INCLUDED IN ARCHIPELAGO.

The general outline of this archipelago is indicated by the map at the beginning of this section. Few realize the vastness of this territory, because most of our maps are on such a reduced scale. In the map presented with this report a very special effort has been made to indicate the comparative size of the United States and also the Netherlands with accuracy. Few people seem to realize that Sumatra has 10 times the area of the Netherlands or that the archipelago, in extending 3,200 miles from east to west, is considerably wider than the United States. Similarly the distance from north to south, 1,200 miles, compares with that from New Orleans to Canada. While it is true that a very great percentage of this total area is covered by the ocean lying between the islands, it is also true that the land area is very great.

CONDITIONS IDEAL FOR TROPICAL PRODUCTS.

Being so near the Equator, practically all of these islands have climatic conditions that are ideal for the cultivation of tropical products and at the same time escape the furious windstorms that occur in other latitudes. In these and many other respects the location is superior to that of the Philippines or Japan. Java ranks about third among the world's sugar producers if measured by the total quantity produced, but in the yield per acre it exceeds all others except Hawaii. Sumatra tobacco enjoys a unique reputation. Much of the world's quinine is from Java. There are many other products that testify to the wonderful climate and fertility of these islands. These were the spices that fired the imagination of the people of Europe in the earlier centuries and induced them to venture out in the discovery ships of those days in search of riches and empire.

POPULATION AND PRODUCTIVENESS OF THE SEVERAL ISLANDS.

While the whole archipelago is potentially wonderfully productive, vast areas are so inadequately populated that they are still left as jungle. In some very extensive areas the people are so primitive as to be of no economic value, and in some cases are so savage as to deter others from developing their territories. At the best the native people of these islands have very small purchasing power.

The total population of the archipelago is about 47,000,000, or about 45 per cent of that of the United States, but the distribution is not at all uniform, as about 35,000,000 of these are concentrated in the two adjoining islands of Java and Madura, which are not quite so long as the distance from New York to Detroit and have a maximum width of 121 miles. The result is that these two islands rank as one of the most densely populated countries in the world, while in contrast Borneo and New Guinea are vast areas lacking in population or given over to savages and can be developed only with great difficulty. The situation is indicated in the following table, from which one can see which areas are populated, productive, and developing and which are backward and probably will continue so for some years:

Islands.	Area.	Total population. 1905	Total population. 1917	Population per square mile, 1917.	Per cent of increase, 1905 to 1917.
Java and Madura	50,554	30,100,580	34,157,383	676.0	13.5
Sumatra	161,612	3,447,330	4,317,232	26.6	25.8
Banca and surrounding islands	4,446	115,189	154,178	34.8	33.8
Billiton	1,863	62,454	59,481	31.9	[1]4.8
Borneo (Dutch only)	212,737	1,233,655	1,515,503	7.1	22.8
Celebes and surrounding islands	71,470	415,499	2,352,048	33.0	466.1
New Guinea (Dutch only)	151,789	[2]200,000	[2]200,000	1.3	....
Others	81,928	2,170,838	4,447,814	6.3	91
Total	736,399	37,745,545	47,203,639	64.1	25

[1] Loss. [2] Estimated.

For convenience in estimating the significance of the above figures a table giving the corresponding data for American States of corresponding size is added:

States.	Area in square miles.	Population, 1920.	Population per square mile.
New York	49,204	10,385,227	211.1
California	158,297	3,426,861	21.6
Oklahoma	70,057	2,028,283	28.9
Connecticut	4,965	1,380,631	278.1
Delaware	2,370	223,003	94.1
Texas	265,896	4,663,228	17.5

It thus appears that New Guinea, the largest island in the world except Australia and Greenland, having a total area of 312,329 square miles (that is to say, much larger than Texas), with soil and climate suitable for the production of any tropical crop, easily accessible to shipping, is destined to remain among the stagnant places of the

earth for want of a suitable population. Borneo, with a total area of 293,496 square miles, is in a very similar condition, although there has been some development there. On the other hand, Java (including the island of Madura, which is so close and so similar as to be almost a part of Java), is very densely populated with an industrious people who, taking advantage of natural conditions, have raised its productivity to a very high point. It is a wonderfully fine island—probably the richest colony in the world. But in considering the above figures and conditions generally, liberal allowances should be made for the small stature, physical weakness, illiteracy, and low purchasing power of these people. Americans ordinarily fail to appreciate such conditions.

A better idea of the rate of development of these different islands can be derived from the figures covering the changes in the European population in each during the same period. Java is now being developed very rapidly. Most of the available land is under cultivation; increased production must come from improved methods, and the Dutch are very scientific. Obviously Sumatra is to be developed next, but Celebes and Borneo are receiving some attention, with the emphasis on the former. Banca and Billiton are given over almost entirely to tin mining. Figures for European population follow:

Islands.	1905	1917	Percentage of increase.
Java and Madura	64,969	111,430	71.5
Sumatra	7,208	13,057	81.1
Banca and surrounding islands	317	541	70.7
Billiton	281	368	31.0
Borneo (Dutch only)	1,382	2,448	76.9
Celebes and surrounding islands	1.572	2,436	55.0
New Guinea (Dutch only)	(1)	(1)	(1)
Others	5,378	8,601	59.9
Total	81,107	138,881	71.2

[1] Uncertain.

GEOLOGIC AND GEOGRAPHIC FEATURES.

Running through Sumatra, Java, and the islands farther east and then curving northward through Amboyna, Boeroe, and Halmahera to the Philippines at Mindanao and on to Luzon is a belt of volcanoes about 6,000 miles long. Hundreds of these volcanoes are extinct, but many are still active, and the combined effects of all form the outstanding feature of the geology of the entire region; the eruptions and earthquakes have broken up the geological formations in many large areas, complicating the miner's problems. But it is not safe to generalize, for the two largest islands, Borneo and New Guinea, have no volcanoes and no earthquakes. Those islands are still largely unexplored and may yet reveal treasures of great importance.

A very peculiar thing about this archipelago is its geographical position. Scientists find a great similarity between the animal and vegetable life of the northern islands and that of continental Asia. Similarly, there appears to be a connection between the southeastern islands and Australia, yet the differences between the two groups are very great. The dividing line between the two groups (the so-

called "Wallace line") is rather sharply drawn, passing south of Mindanao in the Philippines but north of the Pellew Islands and Talaud and Sangi Islands, then between Celebes and Borneo, and, most astonishing of all, between Bali and Lombok, where the strait is only 15 miles wide, "so that we may pass in two hours from one great division of the earth to another, differing as essentially in their animal life as Europe does from America."[1]

Considerations of this sort show clearly that, geologically and otherwise, nature has endowed these islands with a most unusual variety of conditions, and as exploration advances a great variety of developments is to be expected. The region seems to give promise of a most interesting future. Timor has recently shown evidence of rich copper deposits.

INDUSTRIES OF THE DIFFERENT ISLANDS.

BANCA AND BILLITON.

Banca and Billiton are two islands on the direct route between Singapore and Batavia and are very important producers of tin but have no other industries of importance. The operations in Billiton are in the hands of a private corporation. Those in Banca are a government monopoly, and it has been suggested that Billiton will also pass under government control when the present franchise expires, as it will in 1927. Tin was discovered in Banca in 1710, and from that time this island has been a noted producer, although more recently the Federated Malay States and Bolivia have shown greater production. The bulk of the metal is secured from placer operations, but there is also some lode mining in Billiton. The production has been:

Years.	Banca.	Billiton.
	Short tons.	*Short tons.*
1914	15,954	5,084
1915	14,874	5,792
1916	16,319	6,561
1917	15,183	7,154
1918	13,285	7,654

The small island of Singkep also produces a little less than 1,000 tons a year. The placer mines on the above islands are said to be nearing exhaustion, and the decreasing production in Banca during the war suggests that there is some foundation for these reports.

This subject of tin mining is referred to more fully in the report on the Federated Malay States.

DUTCH NEW GUINEA AND DUTCH BORNEO.

Dutch New Guinea can be neglected, as there are no industries there that employ machinery. Dutch Borneo is in a somewhat similar condition, although there are some plantations on the island, some petroleum is produced, some diamonds are mined, and on the island of Pulu Laut off the southeast coast there is an important coal mine that is referred to again hereafter. Borneo is supplied

[1] "The Malay Archipelago," by Alfred Russell Wallace, p. 10.

largely through the markets of Singapore and is consequently removed from the present discussion.

CELEBES.

Celebes also has developed very little. There has been considerable newspaper talk about a body of iron ore that has been discovered there which seems to be associated with nickel and some other interesting metals, but unfortunately no adequate fuel supply seems to be available and the project depends upon either charcoal from the neighboring forests or water power from some sites that are available. The ports of Macassar and Menado handle the growing commerce, which is largely in copra, coffee, hides, spices, and other tropical products. There is a vegetable-oil mill at Macassar and a gold mine at Totok, but careful investigation shows that the imports of machinery are seldom in excess of $1,000 a year

SUMATRA.

Sumatra is also relatively undeveloped but is progressing. Owing to its size and peculiar location it needs to be considered by sections. The western end (Atjeh, with a port at Sabang) and the so-called "east coast," with a port at Medan (Belawan), are on the trade routes connecting with the Straits Settlements at Penang and Singapore, so that this territory, and even to a certain extent Palembang, should be considered in the territory of merchants in the above British ports. It is in this part of Sumatra that the most important coal production has been developed, but even there the coal is scarcely better than a lignite and the quantity is not really large, although it is used on ships that take it on at Sabang, which has been equipped with coal wharves 1,400 feet long, storing sheds with a capacity of 25,000 tons, and five electric coal tips, each with a capacity of 80 tons per hour. The coal mines of this district are operated by the Government as a monopoly. In the east-coast region is a great plantation district forming one of the most noted tobacco districts in the world. Rubber and coconut plantations are also conducted on a large scale. Many of these plantations have British owners, but it stimulates the imagination when one learns that there is also an American rubber plantation of about 100,000 acres. Recently there has been a tendency to plant the African oil palm, and certain Belgian interests are active in it. The southeastern end of the island (the Lampongs) and the southwestern shore (Benkoelen, Padang, and Tapanoeli) should be considered in the territory of merchants in Batavia. At the same time this division of the island into two markets is not a hard-and-fast distinction, as different merchants handle the matter differently.

In addition to the usual tropical products which Sumatra produces in important quantities and which will continue to increase rapidly, the island gives promise of important possibilities as a producer of minerals. The coal operations at Ombilin have been mentioned. In 1919 the Government also took over a concession for the mining of coal at Boekit-Asem, which is not far from Lahat in the Residency of Palembang. It is planned to develop the colliery to a production of 100,000 tons per annum. Gold and silver are produced, the most important operation being in Benkoelen Province

and also near Padang. Petroleum is produced in several districts in the northerly and westerly parts of the island. Near Benkoelen a small blast furnace is in operation producing charcoal iron, and the promoters hope to develop this to the point of meeting the requirements of the archipelago for pig iron, cast iron pipe, etc. In the mountains not far from Padang are sites that can develop a great deal of water power, and it was reported that certain of these are to be developed by Norwegian interests for the fixation of atmospheric nitrogen.

As in the other countries of Asia mentioned in this report, earnest efforts are being made to develop the Netherlands East Indies, and the indications are that these efforts will be centered in Sumatra for some years to come. Among the obstacles to this development is the lack of population—26.6 per square mile as compared to the 676 in Java. Also, the character of the population is not very satisfactory to those wanting laborers, and most of the plantations bring in coolies, largely from India and Ceylon. It is one of the strange anomalies of the Orient that although Java, at its nearest, is within 14 miles of Sumatra, earnest efforts have so far failed to persuade the people of Java to emigrate to this neighboring island, which offers so many more favorable opportunities. Those who have been working on this problem are reported to believe that they are on the point of success. It would be a fine thing for all concerned if this should prove to be true, and it would certainly promote the rapid development of Sumatra and better living conditions for the people of Java. As matters stand, Sumatra is part of the territory supplied by the machinery dealers in Batavia, Singapore, and Penang, and the development of this island will increase the trade of these ports except in those cases where purchases are made direct in the markets of Europe and America.

SMALLER ISLANDS.

The smaller islands of the archipelago, like Bali, Lombok, and Timor, have not yet shown important industrial development. Each is different from the others in many respects, and with the endless variations in geological conditions, animal and vegetable life, and, to a lesser extent, climate, fertility, and population, anything may develop. But as a present-day market for machinery Java is far more important than all of the others combined.

JAVA.

As distinguished from the other parts of the archipelago, Java is densely populated and highly developed, especially agriculturally. With Madura it has an area about equal to New York State but is of very different shape, being 622 miles long, with a maximum width of 121 miles and a minimum of about 55 miles. In this area is crowded a population about a third as great as that of the United States, subsisting almost entirely on agriculture but also employing nearly all of the machinery imported into the archipelago. This island is extremely mountainous, having crowded into its area about 125 volcanoes, of which perhaps thirty are still active. Eruptions and earthquakes are frequent and in some instances very serious. But the more level country is very fertile, has abundant rain and

a good climate, and is wonderfully productive. The principal machinery markets are Batavia, Soerabaya, and Samarang. Batavia is the capital of the entire archipelago and serves the western half of Java as a market. Because it is the capital, all of the government departments are there, and business having to do with roads, railways, harbors, and mines for the whole archipelago centers there. It is also the center of the tea-producing district, in which there are about 300 plantations. The rubber-producing section, with nearly 400 plantations, also centers quite largely in this section. Cinchona (from which quinine is made) also centers here and is produced on more than 100 plantations. There are about twenty merchant firms in Batavia that sell machinery; most of these are Dutch, but there are also German and British merchants. Some of these companies have large stocks of machinery and excellent showrooms.

Soerabaya, near the eastern end of the island, is even more important as a machinery market, as it is the port for the sugar-producing district which occupies the larger part of this end of the island, extending almost to Samarang on the north coast. This sugar district is very important, producing a little less than 10 per cent of the world's supply. About 375,000 acres are planted, which, allowing for rotation of crops, represents about 1,500 square miles of the best kind of agricultural land, which is handled in a most scientific way. The crop is handled in 211 sugar factories, about 180 of which may be classed as large "centrals," and the yield is about 1,500,000 to 2,000,000 tons of sugar per year. The largest individual plant produced nearly 50,000 tons of sugar in 1918. Of the 177 factories that submitted reports on their operations to the Research Station Association of the Java Sugar Industry in 1919, 49 per cent employed the ordinary defecation process, 38 per cent used the sulphitation process, and 13 per cent used the carbonation process. Of the factories that reported in 1918 about 47 per cent produced white sugar and 53 per cent raw sugar. There seems to be a tendency to produce whiter and better sugars, and this is creating a demand for improved equipment for the mills in Java. In all such matters the Dutch are very methodical and scientific and are deserving of the highest praise for the care with which they manage their enterprises. This is illustrated by the fact that they have increased the yield of sugar per acre from 6,294 pounds in 1894 to the levels shown by the following table, which was taken from the Indian Trade Journal of September 29, 1921:

Years.	Number of factories.	Acres under cane.	Cane harvested: Long tons per acre.	Pounds of sugar extracted per acre.	Sugar extracted on 100 cane.
1911	185	335,600	41.94	9,617	10.26
1912	184	346,800	41.53	8,910	9.63
1913	190	359,200	41.63	9,110	9.65
1914	186	366,000	40.87	8,495	9.28
1915	186	373,500	37.99	7,788	9.15
1916	186	385,290	41.11	9,238	10.03
1917	185	396,440	43.09	10,117	10.50
1918	186	402,943	38.44	9,723	11.19
1919	179	340,138	38.10	8,657	10.06
1920	183	385,647	37.34	8,826	10.55

These results are the best secured in any important sugar-producing country in the world with the possible exception of Hawaii.

As each of these plants represents a very heavy investment, the total sum represented by the sugar machinery in Java certainly exceeds $50,000,000 and probably amounts to more than double that sum. This equipment is imported through 10 or more of the ports of Java, as shown in the following table; but the market centers in Soerabaya, though some of the business also goes through Samarang:

Ports importing "machines for sugar factories."	1910	1913	1915	1918	1919	1920
	Guilders.	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*
Soerabaya	1,698,796	1,823,915	1,189,902	681,980	2,595,735	2,375,513
Samarang	737,572	1,443,996	582,526	231,441	1,064,210	1,717,486
Cheribon		257,567	320,744	8,154	344,900	38,963
Tegal	224,957	792,136	69,674	9,600	305,966	452,773
Pasuruan	334,223	193,441	135,923	49,660	289,714	416,376
Probolingo	254,417	220,650	181,498	6,065	38,543	185,427
Tjilatjap	797,278	805,042	579,702		23,556	45,883
Panarukan		154,110	31,381		14,969	54,102
Batavia			21,301			14,096
Pekalangan		89,348	11,540			20,220
Others	248,399			100	5,750	
Total	4,295,642	5,780,205	3,124,191	987,000	4,683,343	5,320,839

In addition to its importance as a market for sugar machinery, Soerabaya also has important railway shops and dockyards and supplies engineering equipment for a number of vegetable-oil mills and the petroleum fields near Rembang in northern Java and those in southeastern Borneo. To supply all these demands there are in the city about 35 machinery merchants, whose stocks are even larger, whose show-rooms are more attractive, and whose repair shops have better equipment and larger capacity than those found in Batavia. Of the above merchants, about a dozen are strong Dutch companies, several of which have branches in New York; half as many are German; three or four are British, also possibly having offices in the United States; while the remainder are mostly comparatively small.

Samarang, on the north coast, about halfway between Batavia and Soerabaya, is less important as a market. It is so placed that it is close to the whole central part of Java and has a demand for the classes of machinery used at both ends of the island. There are about a dozen machinery merchants in the city, but practically all of these firms also have offices in Soerabaya or Batavia or both. Also, the volume of business done in these offices seems smaller than in the other cities.

RAILWAYS.

Java is also the market where railway equipment is sold, even though it is used in the other islands. The Government railways included at the end of 1919: Java, 1,559 miles of 42-inch gauge, 65 miles of 24-inch gauge; Sumatra, 303 miles of 42-inch gauge, 318 miles of 30-inch gauge; total, 2,245 miles.

Private railway lines—the so-called "tramways"—have been extended, until at the end of 1918 they totaled about 1,366 miles of different gauges (mostly 42-inch) divided among three principal com-

panies. The total railway mileage, according to the above figures, is 3,611, but there is reason to believe that in addition to this there are certain short lines. There is one short railway line in Java that is of 4-foot 8½-inch gauge.

In addition to the materials required by the above railways, a great deal of equipment is needed for the many plantation railways. The sugar industry creates a great demand for materials of this sort, and most of these plantation lines are of 24-inch gauge; much of the line is portable and moved from place to place each year in order to reach the cane, which is grown on different areas in order to rotate the crops.

The following returns show the volume and origin of rolling-stock imports:

Years.	Netherlands.	United Kingdom.	Germany.	United States.
	Guilders.	*Guilders.*	*Guilders.*	*Guilders.*
1907	1,163,000	53,000	123,000	....
1908	1,625,000	38,000	142,000	....
1909	1,724,000	23,000	161,000	....
1910	1,879,000	17,000	382,000	2,000
1911	2,862,000	47,000	259,000	....
1912	2,875,000	147,000	286,000	4,000
1913	3,483,000	106,000	288,000	....
1914	4,179,000	24,000	429,000	25,000
1915	1,781,000	51,000	29,000	28,000
1916	1,011,000	15,000	....	180,000
1917	183,000	22,000	....	307,000
1918	34,000	31,000	....	1,216,000
1919	1,409,000	24,000	26,000	4,811,000
1920	[1] 2,591,000	[1] 61,000	[1] 341,000	[1] 230,000

[1] Java and Madura only.

Although they may not be strictly relevant in a report covering markets for machinery, the following figures giving corresponding particulars of the imports of rails, fishplates, and base plates provide further evidence of the position of American materials in this market and are also of interest because these materials are imported and marketed by the same merchant organizations that deal in machinery:

Years.	Netherlands.	United Kingdom.	Germany.	United States.
	Guilders.	*Guilders.*	*Guilders.*	*Guilders.*
1910	1,941,000	....	216,000	....
1911	1,501,000	....	220,000	....
1912	2,490,000	....	232,000	....
1913	3,434,000	....	131,000	....
1914	2,586,000	....	109,000	....
1915	1,566,000	....	52,000	185,000
1916	905,000	....	....	442,000
1917	108,000	....	....	989,000
1918	29,000	....	....	511,000
1919	661,000	....	....	6,259,000
1920	[1] 5,247,000	[1] 175,000	[1] 323,000	[1] 6,710,000

[1] Java and Madura only.

NOTE.—By far the greatest part of this material is shipped to Soerabaya, and nearly all of the remainder goes to Samarang.

ROADS.

Java has an excellent system of good and well-kept roads, some of which were built possibly a century ago. As a consequence the automotive vehicle is of much greater service than in many other parts of the Orient. Owing to the mountainous nature of the country some of these roads are difficult in spite of the fact that they may be wide and well surfaced, as for example the route over the Gedeh ridge a little way out of Buitenzorg, which has a 25 per cent grade for possibly 2 miles.

In addition to the existing roads, which are numerous and excellent, there is a definite road program for the construction and maintenance of a system of trunk highways, the preliminary plan for which contemplated an expenditure of 24,000,000 guilders. Of this a little less than 1,000,000 had been expended at the end of 1918, all under the control of the central government. In addition to this there is a further system of provincial roads constructed and maintained under the provincial governments. Formerly these were under the central government, but they are being transferred and it is planned that by the end of 1927 this transfer will be complete. It is possible to travel about Java in an automobile with great comfort, and, as the landscapes are most beautiful, such a trip is very attractive.

In the other islands road building has made comparatively little progress, although a similar general road plan has been made for Sumatra and at the end of 1918 about 16,000,000 guilders had been so expended on a program estimated to involve 63,000,000. Other roads are being constructed in Celebes, Bali, Timor, Sumbawa, Sumba, and Flores. The large islands of New Guinea and Borneo have no roads of importance, but plans are being prepared for a system of highways in the latter.

RICE MILLS.

There are about 150 rice mills in the colony, most of which are in the hands of Chinese. The rice for local consumption is hulled almost entirely in the old primitive way. The existing mills are small, having capacities of from 7,000 to 35,000 pounds of hulled rice per 10-hour day. From what could be learned a fair amount of the machinery for this work was of American make, although there were a number of plants equipped by the German firms F. H. Schule and Huckanf & Buhle. There is a reasonable prospect that gradually additional small rice mills will be installed. Rice is grown very widely throughout the archipelago, but the greatest production is in Java and Madura, where the crop totals about 3,500,000 tons per year. It would seem that there is a distinct opportunity to improve upon the present ways of cleaning this food grain. As the quantity grown is insufficient, large quantities are regularly imported.

COCONUT-OIL INDUSTRY.

Although there are 226 coconut plantations in the Dutch East Indies, the largest part of the crop is obtained from the trees that are less systematically cultivated by the local people, and, as this production has been bringing them good returns, additional trees

are being planted. The yearly crop for Java and Madura is about 350,000 tons of copra from 37,000,000 fruit-bearing trees. As 26,000,000 more have been planted, the yield is expected to increase rapidly. The other islands produce about 380,000 tons, from 23,000,000 fruit-bearing trees. These figures were compiled in 1917. There were also 21,000,000 more, not then fruit bearing. Since about 1907 efforts have been made to extract this oil in modern factories, although no hydraulic presses were employed before 1910. In 1918 it was reported that there were 20 oil factories in Java using hydraulic presses, the total capacity of these mills being about 135,000 tons per year. Large extensions were planned, so that it is probably safe to estimate that this capacity now (1921) exceeds 200,000 tons of copra per year. Other plants have been installed in some of the other islands, such as the one at Macassar in Celebes, and it may be estimated that the capacity of these plants approximates 50,000 tons of copra per year.

Heretofore the cake produced by these mills has been used for fertilizer, but steps are being taken to use it for cattle feed. Also, in the past the copra has been dried in a primitive way, but certain of the oil-mill interests are experimenting with what might be called "drying houses." It is not yet possible to say what form of dryer will ultimately be adopted, but the subject is being studied, as the showers cause deterioration of the sun-dried product. If satisfactory dryers can be developed it is probable that the Government authorities will arrange to have them placed in the different producing districts. Serious efforts will be made to improve the grade of copra produced, not only in the matter of drying but also in making sure that only ripe nuts are picked. Strong interests are also trying to establish this industry on the best possible basis, and the indications are that this will be done with characteristic thoroughness.[1]

There is also a large general demand for machinery. Many classes of industry are under consideration. Refrigerating plants will be added to the abattoirs in the leading cities. Pumps are needed for municipal and other supplies. An experimental weaving mill is to be installed. It is said that the railways of the archipelago will be extended until there is a total of 10,000 miles. Machinery as used in road making and maintenance is in great demand. It is reported that a cement plant is to be installed. The blast furnace for iron in Sumatra has been mentioned. It is expected that there will be a demand for 18,000 tons of cast-iron pipe per year, all of which is now imported. Projects for two pulp mills are under consideration. There are now about 20 sawmills in Java and 110 more in the other islands. Many of these are very small, but some are fairly large and use American machinery. Further demand for such equipment is anticipated.

ELECTRICAL ENTERPRISES.

It is believed that the following is a reasonably complete list of the electrical installations in the archipelago, although, of course,

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[1] The writer is indebted for much of this information to "Olie Industrie in Nederlandsch Indie," by B. Streefland, published in 1918.

it omits the very large number of small plants used on every important plantation, the gold mines, sugar mills, etc.:

GOVERNMENT PLANTS IN JAVA.

Place.	Number and capacity.[1]	Drive.	Characteristics.
Kalianget	2-240 h. p	Diesel engine	220 volt D. C.
Madioen	2-1,000 h. p	Water turbine	3 phase, 50 cycles, 25,000 volts.
Batavia	3-245 k. w. 1-40 k. w. 2-15 k. w.	Steam engine	230 volt D. C.

GOVERNMENT PLANTS NOT IN JAVA.

Place.	Number and capacity.[1]	Drive.	Characteristics.
Poeloe-Laoet, Borneo	2-1,000 k. w	Steam turbine	3 phase, 50 cycles, 6,000 volts.
Banka	2-1,000 k. w 2-2,000 k. w	do	3 phase, 50 cycles, 30,000 volts.
Ombilin, Sumatra	1-3,000 h. p 1-2,000 k. w	Steam engine Steam turbine	3 phase, 50 cycles, 6,000 volts.
Padang, Sumatra	2-500 k. w	do	3 phase, 50 cycles, 6,300 volts.
Benkoelen, Sumatra	2-660 k. w	Water turbine	3 phase, 50 cycles, 25,000 volts.

PRIVATE INSTALLATIONS IN JAVA.

Place.	Number and capacity.[1]	Drive.	Characteristics.
Samarang	3-400 k. w. 1-800 k. w.	Water turbine	3 phase, 50 cycles, 30,000 volts.
Pasoeroean	1-170 k. w	Diesel engine	3 phase, 50 cycles, 6,000 volts.
Malang	2-170 k. w	do	Do.
Bandoeng	3-400 KVA	Pelton wheel	Do.
Soerakarta	4-400 h. p	Diesel engine	3 phase, 50 cycles, 3,000 volts.
Soerabaya	2-600 h. p 3-1,250 KVA	do Steam turbine	3 phase, 50 cycles, 6,000 volts.
Batavia	2-1,500 k. w 2-250 k. w 1-750 k. w	do Steam engine do	3 phase, 50 cycles, 7,000 volts. 1 phase, 50 cycles, 2,000 volts. D. C. 550 volts for tramways.
Toelbengagoeng	1-33 h. p 1-55 h. p 1-100 h. p	Diesel engine	230 volt D. C.
Probolingo	2-18 k. w	do	3 phase, 50 cycles, 220 volts.
Dondowoso	2-32 k. w	do	Do.
Djember	2-52 k. w	do	3 phase, 50 cycles, 3,000 volts.
Bandjoewangi	2-40 k. w	do	3 phase, 30 cycles, 220 volts.

PRIVATE INSTALLATIONS NOT IN JAVA.

Place.	Number and capacity.[1]	Drive.	Characteristics.
Medan, Sumatra	1-380 k. w	Diesel engine	3 phase, 50 cycles, 3,000 volts.
Billiton	4-1,200 h. p	do	3 phase, 50 cycles, 30,000 volts.

[1] The first figure in this column represents the number of units.

OTHER INDUSTRIES.

It has not seemed practical to submit a list of the different industrial enterprises in this archipelago; not only would the list be long and complicated but it is easy to convey an inaccurate impression. For example, the West Java Engineering Works, near Buitenzorg, advertise that they will build bridges and other forms of structural steel work, including buildings for tea and coffee plantations, etc., and a visit to the plant shows that they are equipped to work up about 10 tons of steel a day, but when the writer was there it was found that, although they could punch up to a 1-inch hole in a half-inch plate or shear a 6-by-6 angle no power was used in the plant. The tools used were all hand-power types imported from Germany.

This incident raises the old and much-discussed topic of offering types of machinery wanted by a buyer rather than offering standard types. Nothing could be further from American standards than the equipment found in this neat and successful little shop; if it is necessary to produce such machines to enter the machinery trade of Java, no American manufacturer will find it worth while. On the other hand the indications were that this little plant would soon install a complete power-driven equipment.

FUEL.

Industry in the Netherlands East Indies is handicapped by its fuel problem, just as it is in so many other parts of Asia, though conditions here are not so extreme as in some of the other districts. The archipelago produces a good deal of petroleum, and the usual products are obtained by refining, but even with these supplies, which are often used in Diesel engines, and despite the fact that some coal is mined in the archipelago, fuel is also imported from Japan and Australia and even from Cardiff. It seems a little strange that coal should be obtained from such widely scattered fields, especially when it is known that large quantities of good coal lie in Bengal and Kwangtung.

In 1914 Cardiff coal was on the market of Java at prices from \$7.60 to \$10.40 per long ton. Coke could be secured at \$14.50 to \$17.20 per long ton. In 1918 these fuels were off the market. Japanese coal was offered at \$28 per ton c. i. f. Soerabaya. At the same time Australian coal was \$30 per ton and Borneo coal \$12 to \$15.

The coal consumption of the Dutch East Indies is about 800,000 to 1,000,000 tons and is rapidly increasing. The following tables show imports and local production:

COAL IMPORTS.

Sources.	1914	1915	1916	1917	1918	1919	1920
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Australia	222,000	111,000	40,000	13,000	8,000	56,000	103,000
Japan	75,000	173,000	137,000	61,000	88,000	32,000	51,000

LOCAL PRODUCTION.

Years.	Ombilin mines, Sumatra.	Poeloe-Laoet mines, Borneo.	Other.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*
1914	487,455	141,355	54,660	683,470
1915	498,455	129,481	52,975	680,911
1916	555,900	136,515	131,279	823,694
1917	531,542	132,924	....	....
1918	524,546	133,562	....	....

Considerable difficulty is being experienced in increasing this production. Also, the quality of the imported as well as the domestic coals is not satisfactory; they are friable, high in volatiles, and high in ash. Steam economy is very necessary in this territory, and effi-

ciency should be emphasized in furnace design. There are a few water-tube boilers in use, but for common service, especially in the sugar mills, the type ordinarily adopted is the so-called "elephant boiler," which is practically a return tubular boiler perhaps 7 feet 6 inches in diameter and 18 feet long with a separate overhead steam drum 2 feet 6 inches in diameter and 9 feet long and two separate mud drums placed diagonally, each 2 feet 6 inches in diameter and 21 feet 3 inches long, separated 4 feet between centers.

It can not be emphasized too strongly that no boilers should be sent to the Dutch East Indies unless they are especially built to meet the requirements of the local law covering construction, inspection, and operation. This so-called Java steam law differs from the usual American practice but is strictly enforced. In a recent paper presented before an engineering body in Java, Mr. A. Kovring, an engineer in the steam-engineering department of the Netherlands East Indian government, showed how in a given instance the American rules would allow a working pressure of 158 pounds per square inch while in Java the conditions might be such as to reduce this to 116 pounds. Undoubtedly this is an extreme instance, but there are many American boilers in Asia operating at reduced pressure because of failure to comply with the local laws. This is not merely a question of superior engineering, for in most instances the American practice is far more up to date. Very commonly these laws in Asia are not framed to recognize quadruple-riveted joints or spring-loaded safety valves, and, since they are still in force, the user finds it necessary to comply with them.

DIESEL ENGINES.

From the list of electrical enterprises on page 198 one can make an estimate of the extent to which Diesel engines are employed. A certain firm in Soerabaya claimed to have sold more than 50 Diesel engines ranging in size from 50 to 600 horsepower each. Figures showing the number of oil engines exported from the United States have already been given. A great many British engines are also in service, the figures being: 1915, $82,275; 1916, $153,580; 1917, $69,665; 1918, $40,360; 1919, $102,447; 1920, $118,228.

It is possible that these figures include some Diesel engines, as many British Diesels are in service, but one gathers the impression when visiting the territory that there are also a great many British semi-Diesel engines at work.

WATER POWER.

Under existing conditions it is obviously desirable that the water-power resources, especially in Java and Sumatra, be developed as fully as possible, and, as shown by the tables above covering the electrical installations, something like 20,000 horsepower has been developed in Java and possibly 5,000 horsepower elsewhere. About an equal amount, both in Java and outside, is in course of development. Also there is under consideration a rather elaborate plan for electrifying certain stretches of the railways, especially in the neighborhood of Buitenzorg.

No adequate survey of the water-power resources of the archipelago has ever been made, but a special branch of the government has been created for this purpose, and about 20 engineers are constantly employed. The total available power in some of the islands has been estimated to be: Java, 500,000 horsepower; Sumatra, 2,000,000 horsepower; Borneo, 2,000,000 horsepower; Celebes, 1,000,000 horsepower. As for New Guinea, no one can even hazard a guess, as the island has not even been explored. Gauging observations are being conducted regularly at about 40 different localities in Java, Sumatra, and Celebes. Of the above possibilities, definite projects have been made for the following: Java, 85,000 horsepower; Sumatra, 325,000 horsepower; Borneo, 100,000 horsepower; Celebes, 150,000 horsepower; total, 660,000 horsepower.

These figures represent only preliminary studies for proposed plants for a variety of purposes, including nitrogen-fixation (fertilizer) plants, mining enterprises, steelworks, railway electrification, etc. Nitrogen projects involving at least half a million horsepower are under consideration in Sumatra, Borneo, and Celebes. Rather elaborate methodical investigations are now being conducted at several prospective sites, and there is reason to believe that the above totals can be increased very much—perhaps doubled.

TRADE-MARKS AND PATENTS.

By the royal decree of August 29, 1919, as amended by subsequent acts, a trade-mark law, similar in its essential features to the Netherlands law, was put into effect in the Netherlands East Indies. Under the provisions of this law the rights of the prior user are indisputably recognized. In conformity with this general principle is the requirement that a trade-mark must be actually used, inasmuch as all rights to its exclusive ownership lapse if it has not been used in trade for a period of three years. However, although registration is not conclusive evidence of ownership, the title of ownership remains in the registrant until his claim is successfully disputed by the original user. Therefore, to establish definitely the rights of the actual owner, registration is essential.

To register a trade-mark, an application, containing the name and residence of the applicant and his place of business or domicile in the Netherlands East Indies, should be addressed to the Industrial Property Bureau at Batavia. Inasmuch as the Dutch language must be used on all documents, the services of a local attorney are indispensable. A clear representation of the trade-mark, together with a list of goods on which its use is intended, must accompany the application. If a color or color combination is a distinct feature of the trade-mark, this fact must be mentioned in the description, and six copies of the mark must be included. For the purpose of publishing a notice of the trade-mark application a cut measuring between 1.5 and 10 centimeters length and width and 2.4 centimeters in thickness is required (1 centimeter=0.39 inch). A power of attorney, authorizing application on behalf of the trade-mark owner, is necessary for effecting registration.

A properly registered trade-mark is valid for 20 years. At the end of this time a renewal for a like period may be secured by under-

going the same procedure as in the original registration. The registration fee is 10 guilders. This does not include the cost of the attorney's services, which substantially increase the official charge.

In case the registration has been anticipated, suit for cancellation must be brought within nine months to obtain the benefits of a simplified procedure. If the trade-mark has been refused registration, appeal may be made to the Court of Justice at Batavia within three months following the rejection.

Although no special legal provisions exist for registering patents in the Netherlands East Indies, protection may be secured under the law of the Netherlands. It is understood that the privileges of registration in the Patent Office at The Hague extend also to the Dutch colonies and possessions. In case the application is filed with the Industrial Property Bureau at Batavia, that office forwards the documents to The Hague. This necessarily occasions delay, which can be avoided by transmitting the required specifications directly to the Netherlands Patent Office.

If a patent has been registered with due conformity to the legal requirements, it is valid for 15 years. A patent application may be refused, however, if it has received sufficient publicity to enable an expert to duplicate it successfully. It is apparent, then, that unless the manufacturer takes prompt steps to secure patent rights in the Netherlands and its colonies he may find that this protection is denied him.

The law also stipulates that unless an adequate working of the invention is undertaken within five years of the issue of the patent, and no satisfactory reasons can be advanced for failure to manufacture, the patent may be revoked. The requirements of the law are complied with if the working is effected in any territory under the jurisdiction of the Netherlands.

In reference to the enforcement of rights secured by patent, the judicial authorities of the Netherlands East Indies may be appealed to in questions involving infringements and matters of a similar nature which do not necessitate action through the Patent Office.

SALES PROBLEMS.

On the preceding pages data have been given which, it is hoped, will provide a general view of the conditions existing in this market and the volume of machinery imported from the various sources. At the end of this chapter are additional trade returns that may facilitate more detailed analysis. The figures issued by the customs authorities of the Netherlands East Indies are given in the table on page 203 and have been subdivided to show the ports of entry of these shipments. In using these figures one should remember that tools as well as machinery are included, as the statement compares with the total for all seven items shown in the table beginning on page 180, except that the latter table contains statistics of the ports of Java and Madura only. Also, business credited to ports in east Java probably applies to the Soerabaya market; while business at Benkoelen, for example, would pass through Batavia as a market. With all of its limitations the following table represents the best statement available to show the comparative importance of the different markets; it includes the main classifications of all industrial machinery entering all the ports of the Netherlands East Indies:

Ports.	1910	1913	1915	1918	1919	1920
	Guilders.	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*	*Guilders.*
Soerabaya, Java	4,962,675	8,726,478	4,391,241	5,465,884	17,606,100	18,064,585
Batavia, Java	1,549,875	4,414,745	1,332,500	2,983,995	8,468,132	7,984,615
Samarang, Java	2,305,638	7,232,385	1,680,237	1,199,814	4,902,592	5,589,341
Tegal, Java	224,957	1,061,788	118,690	143,584	443,436	611,059
Cheribon, Java	....	1,203,335	629,942	43,208	832,990	965,194
Panaruken, Java	....	154,110	64,106	....	396,157	771,992
Probolinggo, Java	254,417	368,973	246,398	6,065	54,430	350,156
Pekalongan, Java	....	208,028	35,776	28,130	....	53,613
Banjuwangi, Java	....	190,911	15,392	....	34,139	....
Tjilatjap, Java	797,278	1,016,083	916,390	3,634	23,556	832,893
Pasuruan, Java	334,223	193,441	226,160	49,660	353,164	434,881
Pangkalan Brandan, Sumatra	352,925	624,329	133,593	265,070	2,128,543	1,338,827
Balikpapan, Borneo	679,259	2,225,359	578,102	551,269	2,669,738	4,064,528
Belawan, Sumatra	249,291	1,455,086	718,678	987,954	2,744,214	4,173,843
Padang, Sumatra	242,917	605,256	38,969	616,208	1,468,885	479,575
Palembang, Sumatra	517,435	774,448	444,113	219,335	664,339	736,987
Tandjong Pandan, Billiton	470,265	513,255	279,098	230,213	1,554,826	1,842,896
Sinabang, Simeulu	....	135,451	37,053	....	242,262	30,281
Benkoelen, Sumatra	185,683	131,940	67,698	242,160	387,804	200,438
Macassar, Celebes	101,836	319,513	105,546	254,929	709,410	390,749
Pontianak, Borneo	74,956	....	9,494	....	130,204	67,840
Bandjermasin, Borneo	28,654	....	....	....	30,160	43,572
Others	276,648	525,885	392,153	129,118	425,135	448,387
Total	13,608,932	32,080,799	12,461,269	13,420,230	46,270,216	49,476,252

As a sales problem the marketing of machinery in the Dutch East Indies differs radically from the other markets of Asia in that the buyers are Europeans, and these Dutch engineers and business men are noted for their commercial and technical ability. On the other hand, most of these enterprises are short handed in comparison to conditions elsewhere, and selling machinery involves a great deal of work in that it is necessary to demonstrate that the proposed installation will be a success under the conditions existing. The buyers have become accustomed to receiving liberal treatment in the matter of guaranties and terms of payment, and it will ordinarily be found necessary to make a very close study of the local conditions in order to meet the special requirements.

During the war, under the conditions of the "seller's market," American manufacturers often required an "irrevocable letter of credit" with the order, and much of the business indicated by the above returns as from the United States was executed on that basis. But such methods will not prove practicable when a "buyer's market" exists, for these terms are harsh and are inconvenient for even the richest and strongest firms. While in Java the writer heard many and serious complaints on this subject. This problem does not arise if a manufacturer deals with an importer who has an office in America, but it acquires great force if the manufacturer attempts to deal directly with merchants or users in Java.

The language problem in this territory is both simple and difficult. The Dutch are accomplished linguists, and individuals are frequently found who know as many as seven languages. Almost every official or business man is fully able to transact business in English, and for international correspondence there will be no difficulty. The usual letters and specifications in English are sufficient. But if a representative is to stay in Java permanently it is obvious that he should acquire the language of the country. Without it he is cut off from many sources of information that ordinarily will be a great assistance. A knowledge of German would also prove useful, as business

is also transacted in that tongue. An engineer, if he is to do the best work, should be of the type that is able and willing, if necessary, to do the manual labor required in installing, testing, and operating equipment until it is accepted by the purchaser. At such times a knowledge of the three Malay languages would be very useful. These qualities, added to those mentioned elsewhere as desirable in a salesman for foreign work, impose conditions that are not easy to satisfy and yet are greatly needed if the best results are to be secured. The importance of this subject can in part be estimated from the fact that some English manufacturers of machinery issue catalogues in Dutch.

The sales manager will find that half-hearted measures will not be successful in this territory, although it is a good machinery market, and its future prospects are excellent. If entered it should be worked hard with a carefully developed sales organization, arrangements being perfected for cooperation with other territories, as many of the orders are placed in Europe and America. Purchases for the Government enterprises, which are numerous and important, are controlled by the Colonial Department of the Netherlands Government at The Hague, but orders placed in the United States would pass through the branch at 17 Battery Place, New York City. Orders placed by the various private companies—sugar, rubber, mining, shipping, tramways, tea, coffee, etc.—will quite commonly be placed in the Netherlands by the board of directors. The sales force should be well organized, so as to cover both ends in negotiations for such business.

In the preceding paragraphs a rough estimate of the value of the machinery trade in this archipelago has been made and evidence has been presented showing that American goods are well received there. American manufacturers and merchants are at liberty to engage in business on the same basis as the various European nationals. There are some opportunities for investments that look attractive. The tariff is revised from time to time, but in general the duty on machinery is not high and there has been no discrimination against American equipment. Formerly the Dutch may have seemed inclined to monopolize the trade of their colony, but a recent announcement from The Hague indicates that they now desire that the more powerful nations should interest themselves in the commercial possibilities of the archipelago. Americans who are interested may be able to secure assistance and information from the semiofficial bureau of information that has recently been established to assist trade by gratuitously furnishing information to foreign clients; it may be addressed Bureau Voor Handelsinlichtingen, 16 Oudebrugsteeg, Amsterdam. This bureau does not attempt to give information regarding the financial standing of firms, but it furnishes statistical information, assists manufacturers to secure agents, and in some instances arranges for the gratuitous exhibition of foreign samples. Manufacturers writing to the above-mentioned bureau should make an effort to prove that they are of sufficient standing to justify cooperation and that the business planned is genuine. In Java there is a somewhat similar institution that proved to be a great convenience to the writer—the Official Tourist Bureau, Rijswijk 18, Weltevreden, Java, which would undoubtedly gladly

assist other travelers. Also, in each of the larger cities there are chambers of commerce ("vereeniging") that were always most helpful and courteous.

MONEY, WEIGHTS, AND MEASURES.

Following is a statement of equivalents:

Gold dollar (G$)=2.50 Dutch guilders (fl.).
British sovereign (£)=12 Dutch guilders (fl.).
Yen (¥)=1.25 Dutch guilders (fl.).
Straits dollar ($)=1.40 Dutch guilders (fl.), nominally.
Hongkong dollar ($)=1.60 Dutch guilders (fl.).
Shanghai tael=2.50 Dutch guilders (fl.).
1 metric ton=1,000 kilos.
1 English, or long, ton=1,016 kilos=2,240 English pounds.
1 short ton=2,000 English pounds.
1 seaton=40 cubic feet=1,132 cubic meters.
1 picul=61¾ kilos=136 English pounds.
1 koijan=27 piculs (Batavia)=30 piculs (Soerabaya).
1 kilo=2.2046 English avoirdupois pounds=2.6792 troy pounds.
1 hundredweight=50.802 kilos.
1 meter=39⅜ inches=3.28080 feet=1.09362 yards.
1 kilometer=0.62138 mile.
1 hectare=2.47114 acres.
1 bouw (bahoe)=7,096.89 square meters=1.7537 acres.
1 acre=4,046.7189 meters=0.57023 bouw.
1 liter=1.761 pints=0.2201 gallons.
1 cubic meter=1.308 cubic yards=35.3166 cubic feet.

DETAILED STATISTICS OF MACHINERY TRADE.

The following table shows the machinery exports (according to official American statistics) from the United States to the Netherlands East Indies:

Classes.	1910 [1]		1913 [1]		1915 [1]	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Elevators and elevator machinery				870		3,284
Stationary gas engines			8	1,934	5	432
Gasoline engines:						
Marine			11	1,658	6	647
Stationary			9	811	2	121
Traction					5	18,217
Steam engines:						
Locomotive			2	13,680		
Stationary	18	5,314	2	620	6	1,789
Traction					2	4,000
All other engines					1	39
All other parts of engines		3,150		1,639		679
Flour and grist mill machinery				7,382		496
Power laundry machinery		1,560		126		
Metal-working machinery		4,365		6,366		9,229
Oil-well machinery						90,257
Other mining machinery		30,627		287,399		1,280
Pumps and pumping machinery		10,272		22,863		21,165
Refrigerating, including ice-making, machinery						2,065
Road-making machinery				199		2,800
Sugar-mill machinery				350		261
Textile machinery				375		47
Sawmill machinery				42,031		20,472
Other woodworking machinery				3,319		3,765
All other machinery and parts of		29,160		32,692		31,485
Total		84,448		424,314		212,630

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		74,303		24,724		66,121
Brewers' machinery		2,000		908		
Concrete mixers		7,775		10,608		
Cotton gins	1	303		261		1,649
Elevators and elevator machinery		26,327		14,983		19,176
Electric locomotives			4	32,099		
Stationary gas engines	28	19,079	35	4,084	32	19,693
Gasoline engines:						
Automobile	2	367	7	3,555	3	928
Marine	192	91,621	41	21,298	57	24,772
Stationary	135	91,389	144	66,226	79	33,840
Traction	47	68,248	184	352,725	133	201,014
Kerosene engines	25	18,409	47	20,833	33	4,183
Steam engines:						
Locomotive	2	10,000	23	682,996	7	80,875
Marine	2	5,276			14	4,165
Stationary	17	16,728	4	6,781	40	22,201
Traction	1	7,400	4	9,300		
All other engines	46	85,619	75	68,040	19	35,307
Boilers		23,917		41,688		102,562
All other parts of engines		162,910		116,804		144,678
Excavating machinery		652		21,500		182
Flour and grist mill machinery		8,072		295		370
Power laundry machinery				86		845
Lathes		273,302		88,826		76,512
Other machine tools		81,144		80,186		104,560
Sharpening and grinding machines		27,412		25,577		17,165
All other metal-working machinery		232,640		131,497		163,059
Oil-well machinery		891,272		667,682		2,673,950
Other mining machinery		248,629		153,307		84,218
Paper and pulp mill machinery		3,680		1,422		9,427
Pumps and pumping machinery		352,207		239,760		374,837
Refrigerating, including ice-making, machinery		9,453		2,330		1,585
Road-making machinery		94,412		91,306		1,891
Shoe machinery		1,277		425		24
Sugar-mill machinery		43,212		183,110		155,842
Textile machinery		1,045		1,595		535
Sawmill machinery		24,638		65,580		20,448
Other woodworking machinery		123,746		52,798		25,521
All other machinery and parts of		1,417,785		677,510		588,945
Total		4,546,249		3,962,705		5,061,080

British exports of machinery to the Netherlands East Indies are shown below:

Classes.	1913	1914	1915	1916	1917	1918	1919	1920
Locomotives	£2,960	£604	£244	£334			£570	
Road rollers	12,827	14,557	14,165	8,757	£3,704	£2,758	14,298	£66,141
Unenumerated prime movers	38,745	33,338						
Internal-combustion engines			16,455	30,716	13,933	8,072	(1)	(1)
Mining machinery	20,561	8,942	6,269	8,842	3,869	482	(1)	(1)
Unenumerated machinery	273,132	242,013	114,607	170,513	160,082	71,243	(1)	(1)
Total	348,225	299,454	151,740	219,162	181,588	82,555		

[1] A change in classification makes it impossible to complete this table. The following totals include typewriters, etc.: 1913, £442,344; 1919, £543,183; 1920, £1,087,800.

Japanese exports to the Netherlands East Indies are shown below (the yen is approximately equal to 50 cents):

Classes.	1915	1916	1917	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Electrical machinery	3,791	14,968	45,709	275,467	446,000	338,000
Telephones	162	152	671	41,515	36,000	1,000
Textile machinery	....	....	1,074	4,267	1,000	....
Lathes	....	....	86,502	314,302	37,000	6,000
Printing machines	477	1,171	2,958	20,380	7,000	10,000
Other machinery	13,947	24,315	58,021	431,118	120,000	75,000
Total	18,377	40,606	194,935	1,087,049	647,000	430,000

PHILIPPINE ISLANDS.

EXTENT AND GENERAL CHARACTERISTICS OF THE MARKET.

As distinguished from India, where the business of the country is divided among about five cities, and Japan, where it is divided between at least two, and China, where it is also split up, foreign business in the Philippines is almost entirely concentrated at Manila. As a consequence the volume of machinery imported into Manila is very large, comparing quite favorably with any other city in Asia. The extent of the participation in this business by manufacturers in the United States is very high, being 70 to 95 per cent in different years as compared with 3 to 30 per cent in India, 15 to 30 per cent in China, and 30 to 80 per cent in Japan. In some years Manila absorbed more American industrial machinery than any other city in Asia. Probably Manila never has fallen lower than fourth place in this respect. As a consequence, the American manufacturer of machinery has a very great interest in this territory, and as the trade is expanding very rapidly this interest grows correspondingly. Because of the large extent to which this business is in the hands of Americans it might almost be considered a part of the domestic market.

The situation is shown in the following table, where the imports of industrial machinery are expressed in pesos, the value of which may be taken at 50 cents, as that value has been maintained through almost the entire period indicated, though there have been times when it went to nearly 15 per cent discount:

Years.	Total volume.	Volume from United States, including Hawaii.	Percentage from United States, including Hawaii.
	Pesos.	*Pesos.*	
1915	2,409,503	1,761,886	73.1
1916	1,606,933	1,303,350	81.1
1917	3,163,111	2,812,719	88.9
1918	7,942,491	7,718,715	97.2
1919	20,137,466	19,239,799	95.5
1920	19,643,223	19,107,264	97.3
1921	16,613,309	15,542,012	93.6

Confidence in the above returns is supported by figures from the returns of the United States customs, which show the following exports of industrial machinery to the Philippine Islands: 1910, \$532,361; 1913, \$1,489,836; 1915, \$689,562; 1918, \$3,753,054; 1919, \$10,007,110; 1920, \$9,861,830; 1921, \$5,529,555.

In all the above figures, adding machines, printing presses, sewing machines, and typewriters have been omitted. The returns of the customs seem to make it necessary to include tractors. At the end of this section the complete returns are given in much greater detail, the various classifications and countries of origin being shown.

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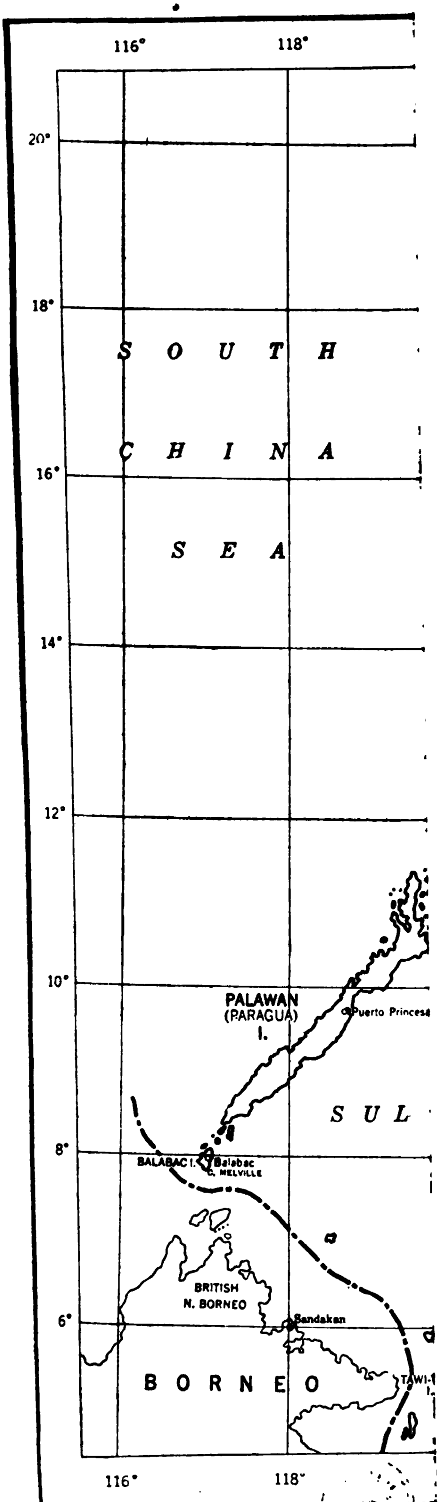

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Obviously, Manila is a splendid market. Its growth has been rapid, but it gives promise of sustaining and increasing the present demand for such machinery. In a sense the fact that Manila has become such an important market for machinery proves the success of American efforts in the islands and, conversely, the continued progress of the Philippines will insure an increasing demand of this sort.

Among the other large business centers of Asia, Manila's nearest neighbor is Hongkong, a port that has long been well advertised, but it should be noted that Manila does more than three times as much machinery business as Hongkong, also ranking far above Singapore, Batavia, Saigon, and other points between Shanghai and Calcutta.

As compared with the other markets of Asia, Manila is peculiarly attractive to the American manufacturer because the entire country shows an American spirit. Those who use machinery, those who do the pioneering and development work throughout the islands are usually Americans or Filipinos who are familiar with American methods and ideas. Such Filipinos know the different kinds of American machinery and recognize the superiority of this equipment.

AREA AND RELATIVE ECONOMIC POSITION.

The Philippines are essentially an agricultural country, the size and proportions of which can be appreciated from the map published at the beginning of this section, showing the archipelago superimposed upon a map of the States of Ohio and Indiana drawn to the same scale. Blessed by nature with splendid, fertile soil, abundant rainfall, and a tropical climate, the Philippines can produce any tropical crop. The area, 114,420 square miles, is a little greater than the combined area of New York State and Pennsylvania (94,330 square miles) and the population (1920), 10,350,640, compares with that of New York State alone (1920), 10,385,227. But there are very few other ways in which these comparisons could be extended, as the mountainous nature of the islands and the way in which they are cut up into an archipelago, together with differences of climate, history, standards of living, and the like, make the differences far more conspicuous than the resemblances. As oriental countries go, the Philippines are not very densely populated, only about 25 to 50 per cent of the arable land being cultivated. It has been estimated that the area susceptible of cultivation is between 15,000,000 and 30,000,000 acres; only about 8,000,000 are under cultivation, of which in 1920 the distribution was as follows:

	Acres.		Acres.
Rice	3, 669, 237	Maguey (a fiber)	75, 532
Hemp	1, 382, 193	Cacao	2, 891
Corn	1, 327, 284	Coffee	2, 941
Coconuts	981, 079		
Sugar	487, 791	Total	8, 178, 827
Tobacco	249, 879		

This acreage represents an increase of about 8½ per cent over that of 1917 and 17½ per cent over 1910. The area devoted to sugar, coconuts, and maguey has more than doubled during the interval, but the area devoted to corn has decreased nearly 400,000 acres. All of

this suggests good, healthy development, which, it is anticipated, will be carried into the future, for even the ups and downs of world reconstruction will not interrupt such pronounced growth. The above products are the foundation for the entire commerce of the islands. The more they produce the more they can buy, and the development in producing power indicated above demonstrates adequate and increasing purchasing power, which has not been exhausted in recent years, if one may argue from the balance of trade, which has been in favor of the Philippines since 1914, except for one year. The trade balances, expressed in American dollars, have been: 1914, $100,981; 1915, $4,500,820; 1916, $24,440,845; 1917, $29,807,276; 1918, $36,595,270; 1919, $5,521,226 (unfavorable); 1920, $1,685,573.

Such a situation is the reverse of the awkward exchange problem associated with the markets of Europe. The Philippines not only want to buy machinery but they are in a position to pay for it.

The following interesting particulars regarding the progress of the country are taken from the "Report of the Special Mission [Wood-Forbes] to the Philippines":

> The Postal Savings Bank was started in 1907, and by 1913 it had 40,000 depositors and $675,000 in deposits. In 1920 these had reached 107,000 depositors and $1,612,500 in deposits.
>
> The law requires that 1 per cent of the gross business done in the islands be paid to the Government in the form of taxes. This business was computed to be $200,000,000 a year in 1907, when the tax was first imposed, and had increased to $325,000,000 in 1913. In 1920 it had reached the figure of $863,000,000. The number of cigars manufactured had increased from 300,000,000 to 500,000,000. The total resources of commercial banks rose from $15,000,000 in 1906 and $31,000,000 in 1913 and are now estimated to be $215,000,000; this, however, includes the impaired resources of the Philippine National Bank without reduction for losses. Money orders sold increased from $8,000,000 in 1913 to $17,000,000 in 1920, and postage receipts from $380,000 in 1913 to $780,000 in 1920. Telegraph receipts show a similar increase. The earnings of the Philippine Railway have risen from $380,000 in 1913 to $750,000 in 1920 and the Manila Railroad from $2,400,000 in 1914 to $5,900,000 in 1920; this latter, however, is partially to be explained by the sharp increase in the mileage and rates.

POPULATION.

The archipelago is made up of 3,141 islands, but about 92 per cent of the area is concentrated in the 11 that are largest. The population in 1920, as stated, was 10,350,640, or about 93 per square mile. The corresponding population in 1903 was 7,635,426. But it should be emphasized that this population is not distributed at all uniformly even over the arable area, and the diversity of types is almost inconceivable, for in this small group of islands, smaller than the State of New Mexico, are 43 separate ethnographic groups or tribes, speaking 87 distinct languages or dialects of most diverse origins, and the types vary from the very primitive people of mountain and forest to the college-trained Filipino. The important element of the population is that including the so-called seven Christian tribes, and these include about 92 per cent of the total population. This is the productive element of the population, and it shows very rapid progress. The leaders in this group are still very largely Spanish-speaking and Spanish-trained and have Spanish ideas and ideals, although this influence is disappearing rapidly. In the short period since the American occupation in 1898 a great transformation has taken place.

COMMUNICATIONS.

Communications have always been inadequate. At present there are 757 miles of railway of 42-inch gauge in the whole archipelago, of which about 625 miles is on the island of Luzon. Although the interisland shipping does much of the work that would be handled by rail in other lands and although one must allow for the mountainous character of the islands, it is still obvious that there is an insufficient railway mileage. Allowance should also be made for the 2,920 miles of first-class roads and approximately an equal mileage of poorer roads. Taken altogether, the transportation facilities are much better than can be found in most Asiatic countries. All these facilities are comparatively new and are being improved and extended. Improved transportation is exerting a strong influence on the development of the people and must, in time, tend toward greater uniformity of type and language.

The problem of opening up the country has been and is difficult. Even now about 12 per cent of the area of the archipelago is entirely unexplored (an area larger than the State of Maryland). Large districts are not yet adequately supplied with roads, and large islands are in need of development. It is reported that in Mindanao there is an opportunity for a water-power development that would produce about a quarter of a million horsepower, but unfortunately the site is away from population and transportation, although only a few miles from the seacoast, and so it seems to be of no immediate value.

COMPARISONS WITH JAPAN AND JAVA.

In many respects the Philippines resemble both Japan and Java in that they are oriental, mountainous, island countries. The climate varies from one to the other, and their cultures have been derived from radically different sources, but the populations all seem to have been at least in part of Malay origin. The following table suggests the comparative value of these markets:

Items.	Philippines.	Japan.	Java.
Area, in square miles	115,026	147,698	50,970
Population	10,350,640	55,961,140	34,157,383
Population per square mile	93	390	671
Exports (1918)	$135,194,482	$981,050,334	$140,392,982
Exports per capita	$12.12	$17.55	$4.10
Imports (1918)	$98,599,211	$834,071,916	$145,531,095
Imports per capita	$9.52	$14.90	$4.26
Machinery imports (1918)	$3,971,245	$19,984,916	$3,971,188
Machinery imports per capita	$0.38	$0.35	$0.116

Java has long been considered one of the garden spots of earth, and under the efficient management of the Dutch has been considered one of the most productive colonies in existence. The fact that the Philippines, with perhaps one-third as many people, export practically as much seems to indicate very rapid and substantial progress. Also, Japan has long been considered as a country of phenomenally rapid industrial development, and yet it appears that the Philippines have an even larger per capita importation of industrial machinery, indicating similar progress.

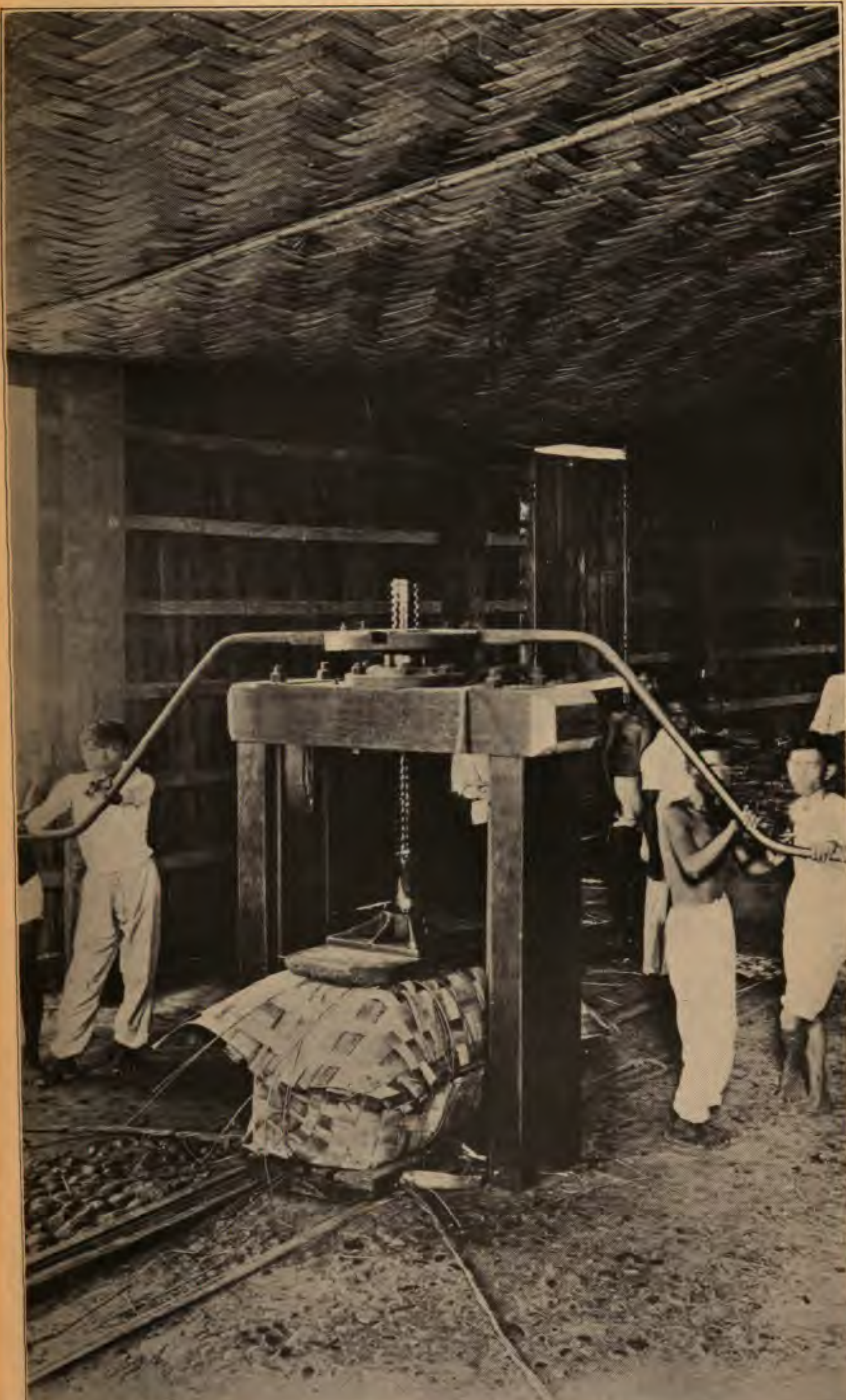
CITY OF MANILA.

It has been pointed out that Manila is the market, the distributing center, for machinery imported into the Philippines. It is the only city in the archipelago and has a population of about 280,000 (Rochester, N. Y., has 296,000). No other community in the islands is a tenth as large. Manila has a population of perhaps 4,500 Americans, an approximately equal number of Spaniards, 16,000 Chinese, and 1,000 Europeans of various nationalities. Although the city shows plenty of Filipino and Chinese life, it is clean, provided with good running water, sewage, cold storage, electric lights and cars, schools, university, hospitals, clubs, churches, and similar institutions. Most of the streets are wide and well paved and connect with the highways of the island. More than 3,000 automobiles operate in the city, and it is easy to drive them about the island. The run of 130 miles to Baguio, the summer and health resort, is very popular. There are also about 500 motor trucks and public-utility automobiles in the city. More than 9,000 motor vehicles operate in the islands. The harbor readily admits the largest of trans-Pacific steamers drawing as much as 30 feet of water. These vessels go alongside piers and discharge direct into warehouses or, if desired, into lighters and transfer to the interisland steamers or to the railway. The port also has good steamship connections for all ports in the Orient, and telegraph, mail, and freight services are exceptionally good. The spirit of the community is alert, making it much easier to conduct business than is the case in many eastern cities.

The machinery business is handled by about 20 merchant firms, most of which are American. There are great differences in the organization of these companies. Some are large, with departments handling other lines as well as machinery and organized to cover the whole territory; some handle only machinery and supplies, with perhaps a hardware business included; some have machine shops and are prepared to make repairs or perhaps manufacture certain lines. Altogether, they represent as agents perhaps 100 foreign machinery manufacturers, most of whom are also American. Although some of these merchants have branches at Cebu, Iloilo, and perhaps elsewhere, the bulk of the machinery business is placed in Manila; in some instances, where the importance of the transaction justifies, buyers go to America. These companies have their offices centrally located and are well equipped for their business. They employ some very good engineers, and almost any problem can be handled in a businesslike way.

MANUFACTURING INDUSTRIES—LIST OF ESTABLISHMENTS.

In the days of the Spanish régime very little manufacturing was attempted. Apart from purely native industries, such as the production of "piña" cloth from the fibers of the pineapple and the preparation of agricultural products for market—particularly rice and hemp—manufacturing was largely confined to tobacco and sugar, and most of the old sugar mills were destroyed during the insurrection. In the early days of the American régime sugar was produced in an inefficient manner, using small mills driven by steam, animal, or water power. A certain amount of mining has



Photograph by Philippine Bureau of Science.

FIG. 25.—TOBACCO PRESS IN USE BY CÍA. GENERAL DE TABACOS, TUGUEGARAO, CAGAYAN PROVINCE, P. I.

Photograph by Philippine Bureau of Science.

FIG. 26.—INTERISLAND BOATS, PHILIPPINE ISLANDS.

been carried on from the early times, and iron is still produced in a very primitive way.

More recently there has been greatly increased activity in a variety of directions, both in the city of Manila itself and in the Provinces; a general idea of this can be obtained from the following table, showing the factories and industrial establishments:

Factories and industrial establishments.	City of Manila.		Provinces.[1]		Total.	
	Number of factories.	Number of laborers.	Number of factories.	Number of laborers.	Number of factories.	Number of laborers.
Abaca weaving			18	29	18	29
Abaca pressing			38	2,829	38	2,829
Aerated water	12	155	28	126	40	281
Alpargatas			1	39	1	39
Apron			1	1	1	1
Bakeries and sweetmeats	64	841	646	2,050	710	2,891
Basi and tuba			393	483	393	483
Billiard pool			1	2	1	2
Boat construction	1	4	15	397	16	401
Bolo and razor			131	308	131	308
Breweries	2	232			2	232
Brick and paving stones			10	110	10	110
Brush			1	3	1	3
Button factory	1	200			1	200
Candle and candlestick	11	61	5	26	16	87
Cars, carriages, and other vehicles	46	332	157	712	203	1,044
Caramel	16	109	2	6	18	115
Carpentry shops	54	147	25	106	79	253
Casco construction			3	16	3	16
Chocolate	29	272	4	9	33	281
Cigarette cases			4	7	4	7
Cigars and cigarettes	42	10,443	46	1,086	88	11,529
Charcoal			6	3	6	3
Coffee grinding	2	4			2	4
Comb	3	7	2	9	5	16
Copra			1,030	4,727	1,030	4,727
Distilleries	14	193	71	590	85	783
Drug	1	16			1	16
Dyeing	4	25	21	111	25	136
Electric-power plants	1	214	6	54	7	268
Fertilizer	1	8			1	8
Firewood			19	145	19	145
Firework			4	8	4	8
Fishing, pearl, and shell	46	180	1,443	5,841	1,489	6,021
Fish net and trap			380	4,417	380	4,417
Foundries and smitheries	51	278	149	1,101	200	1,379
Furniture	83	1,404	74	942	157	2,346
Gas	1	89			1	89
Glass	1	69	1	56	2	125
Harness and saddlery	14	76	16	41	30	117
Native weaving and molding shops	15	789	23	71	38	860
Hemp braid			1	95	1	95
Hemp industry			9	488	9	488
Horseshoes			2	5	2	5
Ice plant	3	83	16	144	19	227
Ink	1	5			1	5
Lantern			1	1	1	1
Lime	2	4	25	151	27	155
Lumber cutting			80	1,229	80	1,229
Machinery, foundry, and shipyards	15	1,105	7	397	22	1,502
Maguey			3	48	3	48
Marble and cabinet	16	60			16	60
Mats			15	43	15	43
Matches	1	253			1	253
Mining			8	1,726	8	1,726
Nipa weaving			48	666	48	666
Oil	2	37	6	18	8	55
Pail and baluster			3	9	3	9
Paste	10	62	4	16	14	78
Perfume	1	14	1	2	2	16
Pottery			41	325	41	325
Preserving factory	1	70			1	70
Printing shops	43	677	20	106	63	783
Rafts	3	6			3	6
Rattan			8	89	8	89
Rattan cutting			62	837	62	837

[1] 128 warehouses, employing a total of 2,463 laborers, and 10 barber shops each employing 1 laborer (owners not included), are not included in this statement.

Factories and industrial establishments.	City of Manila.		Provinces.		Total.	
	Number of factories.	Number of laborers.	Number of factories.	Number of laborers.	Number of factories.	Number of laborers.
Rice threshers			5	197	5	197
Rice mills	2	66	283	4,409	285	4,475
Rope	2	135	2	60	4	195
Sail making	4	14			4	14
Salt			107	1,002	107	1,002
Salted pork	1	5			1	5
Sawmills	21	1,207	58	1,841	79	3,048
Sculpture and marble cutting	18	94	1	1	19	95
Shoes, slippers, and wooden	268	820	342	1,736	610	2,556
Soap	40	144	38	128	78	272
Soup and soup-paste sauce			5	78	5	78
Spinnery	1	251	1	28	2	279
Stock farm			13	43	13	43
String instruments	13	25	2	5	15	30
Sugar mills			3,213	110,300	3,213	110,300
Tailor shops			38	80	38	80
Tanks			1	4	1	4
Tanneries	10	43	47	170	57	213
Tile and bricks	2	103	10	83	12	186
Tin shops	51	118	18	36	69	154
Tobacco-leaf curing			175	6,454	175	6,454
Weaving	1	279	43	778	44	1,057
Total	1,047	21,828	9,536	160,289	10,583	182,117

Obviously the above list includes a great many items that can scarcely be called "factories." Probably a much better basis is the 1920 census, which reported 239 manufacturing establishments, with a combined capitalization of $80,372,934.

Manila is by far the most important industrial city, but it will be noticed that certain important activities have developed in the Provinces, especially in mining, tobacco, coconut oil, rice mills, and sugar.

MINING.

The mineral production of the archipelago in 1920 was as follows:

Gold	$1,212,303	Lime	$5,436
Salt	697,313	Coal	726,100
Sand and gravel	539,525	Iron	20,095
Stone	6,135	Silver	9,630

The silver recovered is incidental to the gold with which it is associated.

Geological conditions are very much against mining, for although evidences of minerals are frequently found, the volcanic origin of the islands has broken up the natural stratification probably to a greater degree than anywhere else in the world. Even if operations are conducted in a seemingly good vein, they may be ended any time through meeting a fault. On the other hand, evidences of gold, copper, coal, and oil exist and may develop into satisfactory mining projects at almost any time. There are also some interesting placer properties.

LUMBER AND SAWMILLS.

It has been stated previously that there are 79 sawmills in the islands, employing 3,045 laborers. The total exports of wood, both manufactured and unmanufactured, in 1918 amounted to approxi-

mately $900,000 and the business has doubled since 1915. But in all of these tropical countries the problems of lumbering differ radically from those in the domestic forests. In virgin American forests it often happens that the standing timber is all of one type or even of one variety over really large areas. On the other hand, a tropical jungle will often show several thousand varieties of trees and shrubs per square mile. The problems of cutting, extraction, and sawing that result deserve most careful consideration. In the teak forests of Siam, Burma, etc., it often requires three years to get the wood to market after it has been selected in the forest. Only rarely is one justified in employing American mills of really large capacity in the Tropics. On the other hand, machinery as so often supplied from European manufacturers is far from satisfactory and is greatly inferior to American standard equipment for such service. Before one designs a mill for the Tropics these conditions deserve most careful analysis.

TOBACCO MANUFACTURING.

In the table below are the figures for the Philippine cigarette industry:

Year.	Number of factories.	Production.	Exportation.
		Number.	*Number.*
1914	83	4,411,922,312	45,628,804
1916	77	4,180,673,512	45,224,542
1918	23	4,720,005,675	119,025,217
1919	23	5,049,138,900	154,192,300
1920	24	5,039,784,441	128,663,141

A very large number of these cigarettes are made by hand, although the principal production is by machinery; the American style of machine is not ordinarily employed, as the market demands a cigarette that is closed at one end.

Cigar production is developing more rapidly:

Years.	Number of factories.	Production.	Exportation.
		Number.	*Number.*
1914	83	243,134,200	152,509,443
1916	77	271,868,278	191,349,900
1918	82	484,674,450	367,022,982
1919	79	499,059,234	389,799,788
1920	91	510,800,333	414,603,650

There seems to be a reasonable demand for equipment used in connection with tobacco. The above figures show an increase in the scale of operations, and in various ways improved methods are being adopted. These manufacturers will be interested in anything they can learn on the subjects of curing, moistening, drying, rolling, wrapping, and boxing.

COCONUT-OIL INDUSTRY.

The coconut-oil industry is one of the most important in the Philippine Islands, and very large sums have been invested in machinery for its extraction. As it is not well understood in the United States, the whole industry seems to deserve brief discussion.

In the world's trade, coconut products represent more than $350,000,000 per year, or perhaps twice as much as rubber. Expressed in another way, it is substantially equal in value to the total production of electrical machinery, apparatus, and supplies in the United States. The principal product is coconut oil, which is edible and very valuable, being largely used in the preparation of margarine, but also in a great variety of other ways, as for toilet purposes, as an illuminant, etc., and is in great demand in the markets of both Occident and Orient. It is obtained by subjecting the meat of the nut to pressure. The residue, a cake, is a by-product and is an excellent feed for cattle. Sometimes it is used as a fertilizer. From the husks a fiber, coir, is obtained, which is used in making the door mats found in almost every home, and also for brushes, rope, etc. The milk, though nutritious, is often wasted.

The market for the oil is highly competitive, as many other vegetable oils can be substituted for it, and also there is competition between different sources of supply, the Philippines growing only from 10 to 15 per cent of the world's production. Operations are conducted on very narrow margins.

Despite this keen competition an important quantity of coconut oil is extracted in Asia by means of equipment that is very primitive. In different countries different types of presses are used, and it is remarkable how effective these methods are; but the best oil mills are equipped with modern hydraulic presses or other types of machinery designed for the work. When the extraction is made in modern mills, it is usually necessary to dry the coconut meat before shipment. In this form the product is called copra, which is shipped to mills in Europe and America in large quantities as well as to mills located in the various countries of Asia.

The shortage of shipping during the war, with the accompanying freight rates, made it very profitable to operate mills in Asia, and more than 30 of these were organized in the Philippines, purchasing oil-extraction machinery, as suggested by the following import returns published by the Philippine customs:

1913	$8,422	1917	$172,427
1914	9,812	1918	1,686,558
1915	144,685	1919	1,558,512
1916	37,734	1920	418,267

The point has been reached where the capacity of the extraction plants exceeds the copra supply by a very substantial margin. Also it seems safe to say that in installing these plants under war conditions efficiency was sometimes sacrificed in order to secure large capacity. But the mills previously installed in America and Europe, especially in France and Germany, are reported to secure very high extraction and efficiency. There is now close competition between the mills in the Orient and those elsewhere, and it has even reached the point where Philippine copra has been exported despite the fact that pressing-plant capacity is available locally.

This competition is greatly influenced by transportation costs. Copra is light and bulky, but can be shipped in bags. The oil sometimes requires the more costly barrels, but both oil and cake are compact. It has been estimated that there is a saving of about $2.50 per ton in favor of pressing the copra before shipment. This arrangement has the further advantage of permitting oil and cake to be sent to separate markets, and the oil is less likely to contain acid if extracted before shipment. On the other hand, if France, for example, levies a duty on the oil and cake but admits copra duty-free, French mills will have an advantage in that territory, and can draw their supplies from Indo-China, Ceylon, British India, Dutch East Indies, South America, Africa, and a variety of other places, as well as the Philippines. The present problem is to so modify the Philippine plants as to secure the utmost efficiency and an absolutely minimum production cost.

Improvement can also be made in the method of drying the copra. The present methods are primitive. As stated above, there are in the Philippines 1,030 plants employing 4,727 laborers. The process commonly employed is not scientific or cleanly, and copra from other countries ordinarily commands a more favorable price in the markets of Europe, where copra from the Malabar coast of India (Cochin) is considered the best. That coast is exposed to the monsoon (trade wind) and has practically continuous sunshine for six months in succession, so that the copra is not subjected to the frequent showers of other countries. It seems that there is need for a good copra dryer. Certain designs are being tested in Java. It will be difficult to design and market a suitable device, but once this is done it will be an exceedingly good thing for the Philippines, as well as for consumers of margarine.

Coir also introduces an interesting problem. Of all the countries producing coconuts this particular product seems to come only from the Malabar coast, where conditions are peculiarly favorable for its production. It would be a splendid thing for the Philippines if they could be placed in a position to participate in this business, since it is almost as important to India as the copra itself and has an important influence on competitive prices of copra, oil, and cake.

The manufacture of coir in India is a cottage industry, most of the work being done by women. The coconut husks are buried from 8 to 16 months in pits that expose them to sea water in such a manner that the tide washes away the products of decomposition. Afterwards these husks are removed and beaten on stones until all pulp and particles are removed, leaving the fiber. Presumably this industry could be improved by the introduction of modern methods and mechanical help. So far as known, no American manufacturer produces machinery for this purpose. Something has been done in Europe, but it is felt that those methods could be improved.

Some specialists who devote their time to such subjects have come to the conclusion that more profit can be secured per acre by planting the African oil palm than can be obtained from coconuts, and in certain sections of Asia the new plantations will probably be of this kind. This palm yields two different oils, palm oil and palm-kernel oil, both of which compete with coconut oil for many purposes. Machinery manufacturers should note that the palm kernel is rather

more difficult to handle than copra, and the fruits from which the palm oil is derived are a very special problem, in that the oil must be extracted very promptly to avoid rancidity and acid.

There will probably be a considerable demand for machinery to extract both palm-kernel oil and palm oil for several of these eastern countries within the next few years.

RICE MILLS.

As stated, the Philippines contain 3,380,734 acres planted to rice, producing in 1918 about 1,104,805 tons, to handle which there were 285 rice mills employing 4,475 laborers. In addition, 175,000 tons of rice were imported, representing a total consumption of about 235 pounds per capita per year. The returns of the Philippine customs give the following figures for imports of rice threshers, hullers, cleaners, and parts thereof:

Years.	United States.	United Kingdom.	Germany.	Japan.	Total.
1913	$32,055	$10,991	$61,763	$100	$104,909
1914	26,977	4,816	65,990	17	97,800
1915	21,934	10,350	2,943	2	35,229
1916	3,152	623	1,615	5	5,395
1917	12,101	2,122	....	106	14,329
1918 [1]	19,847	96	....	61	20,012
1919	73,260	312	....	938	74,510
1920 [2]	184,393	3,143	14,232	....	201,807
1921	118,234	8,740	557	....	127,531

[1] China, $8. [2] China, $39.

These figures are shown in detail in order to call attention to the fact that Germany and the United Kingdom participated rather more than one would expect, and the figures for Japan and China are shown as an indication of the simple character of their products. American manufacturers enjoy an excellent reputation for their rice hullers and polishers—a line of comparatively small machinery. They are also in a position to supply mills of large capacity that show excellent performance. But the German firm of Nagel & Kaemp developed an intermediate grade of milling machinery consisting of a special grouping of equipment to which they gave the name "Filipina" and which includes a huller, a sieve, a husk separator, a paddy separator, a polishing cone, a sifter, and an exhauster, together with belting, elevators, pipes, etc., mounted in an iron framework complete, thus comprising what might be called an elementary rice mill. These were offered in four different sizes, giving capacities from about 400 pounds to about 3,000 pounds per hour. For districts where millers wish to exercise greater care in protecting the rice from breakage, additional polishing equipment is obtainable. From what could be learned, these sets were very popular in many of the countries of Asia, and it is suggested that American manufacturers might find it profitable to develop something that would do better work at these capacities.[1]

[1] A copy of Nagel & Kaemp's catalogue describing the above machinery is on file in the Bureau of Foreign and Domestic Commerce, Washington, D. C.

It appears that imports of this class of machinery have been considerably reduced for several years and that a good demand can be stimulated if suitable plant can be offered, not only in the Philippines but elsewhere.

SUGAR INDUSTRY.

In ordinary years the sugar industry absorbs a much larger volume of machinery than the coconut-oil industry, imports to the Philippines in recent years being:

1913	$1,000,495	1917	$373,356
1914	170,030	1918	469,489
1915	114,619	1919	3,375,164
1916	124,587	1920	2,431,974

A brief consideration of the history of this industry is necessary before one can appreciate the present position. Cane sugar has been exported regularly for more than a century, about 148 tons being shipped in 1795, which increased to 47,000 tons in 1854 and reached a maximum of about 200,000 tons, on the average, in the period between 1890 and 1894. From this time on production was affected by a number of factors:

(*a*) The insurrection which resulted in war and culminated in the country passing under American control. These disturbances resulted not only in the interruption of production but in the destruction of most of the existing machinery.

(*b*) Up to this time the cane sugar in the markets of the world was the old-fashioned "brown sugar" ("muscovados," etc.). But the development of the beet-sugar industry in Europe created a demand for better qualities, to supply which the producers of cane sugar required improved mills for its production. Other producing countries met this demand, but the disturbed political conditions prevented the Philippines from doing so.

(*c*) An epidemic of rinderpest, about this time, destroyed more than 80 per cent of the work animals on the plantations.

(*d*) During the period involved in the above-mentioned disturbances and the paralysis that resulted from them, the industry in the Hawaiian Islands, Formosa, and Java has been expanded until those countries are understood to be producing at full capacity, with but small promise of further increase.

(*e*) The situation seems to indicate that the Philippine Islands can be developed to meet the increasing world demand and that a period of development may be expected.

The methods of producing sugar have been unsatisfactory on both the agricultural and the extraction sides. The plowing has been only to a depth of perhaps 6 inches, and, as shown above, there are 3,213 mills, employing 110,300 laborers. Most of these are three-roller mills, often of wood, and driven by animal or water power, but sometimes by steam.

However, this phase of development is passing rapidly. Scientific methods of growing the cane are being employed, and there are now modern "centrals" in operation, with a total capacity of 21,870 tons of cane per day. The largest existing plant has a daily capacity of 1,800 tons. Also, there are 16 plants, each with a capacity of 500

tons or more of cane per day. These plants have run long enough to demonstrate that they are earning good dividends. The normal expansion of the sugar industry in this part of the world seems to center now in the Philippines, and the destruction of the beet-sugar properties in Europe during the war encourages the belief that market conditions will stimulate a very rapid development in this territory. From what could be observed, the new plants represent the very best practice in this class of engineering, and in the near future the Philippines should be exporting increasing quantities of high-grade sugar.

The position of the Philippines among the sugar-producing countries of the world is indicated in the report covering India, but it should be remembered that Philippine development is very rapid. The sugar production in recent years has been:

	Tons.		Tons.
1910	168,000	1916	386,000
1911	268,000	1917	400,000
1912	267,000	1918	437,000
1913	322,000	1919	417,916
1914	382,000	1920	180,000
1915	398,000		

The exportation quite regularly exceeds 200,000 tons and reached 370,000 tons in 1916. The most productive Provinces are Occidental Negros and Pampanga.

During the period from January 1, 1916, to July 1, 1919, 24 sugar corporations were registerted with the authorities, involving a total capital of $11,824,154, or perhaps half a million dollars each.

GENERAL INDUSTRIAL SITUATION.

In connection with the above paragraphs regarding special enterprises, and with due regard for the fact that we are dealing with an agricultural and tropical country, it is felt that a general picture of the present situation and trend of development can be obtained from consideration of the following table, which shows the new business corporations registered in the Philippines from 1909 to 1919, inclusive. Attention should be called to the large average capitalization of the sugar mills and the low average for the rice mills and electric light and power plants:

Types.	Number.	Capital.	Types.	Number.	Capital.
Aerated water	4	$76,000	Mining	110	$21,130,900
Box factories	1	75,000	Oil factories	31	4,625,500
Button factories	1	50,000	Paper factories	1	250,000
Cigar and cigarette factories	12	3,629,000	Printing and publishing	32	830,855
Cotton spinners	1	500,000	Rice mills	14	519,732
Distilleries	16	4,733,500	Sack and bag factories	1	40,000
Electric light and power	23	3,364,350	Sawmills	1	15,000
Engineering construction and repair	35	4,931,500	Shoe factories	3	281,000
Fertilizer factories	1	50,000	Soap factories	1	5,000
Gas factories	1	25,000	Sugar mills and refineries	25	11,896,153
General manufacturers	9	1,043,000	Tanneries	1	200,000
Ice factories and cold storage	7	243,000	Telephone and telegraph	1	50,000
Lumbering	26	2,779,500	Transportation companies	85	10,226,010
Match factories	1	400,000			
Machinery merchants	2	675,000	Total	446	73,350,660

These data exclude 35 foreign corporations with capital of over $150,000,000 and 246 private partnerships with capital of more than $17,000,000, all engaged in general manufactures. It is not possible to say how much of this foreign money is in the islands.

These particulars support the claim made in other sections of this report that industrial development has started seriously. A distinct demand is felt for greater facilities of various sorts, business men and Government officials are disposed to encourage the establishment of industrial enterprises, and the legislature has passed a number of bills for this same purpose. The Bureau of Commerce and Industry has been added to the Department of Commerce and Communications in order to give careful study to industrial matters and encourage improvements or new enterprises where practicable. Although the Rizal Cement Co. is producing cement, the demand for more and cheaper cement is so insistent that special legislation has been enacted creating the National Cement Co., in which the government holds stock. In like manner the fuel situation has been unsatisfactory, and the National Coal Co. has been organized and is engaged in the development of certain mines. Needs having been felt in several other directions, the National Development Co. has been organized, and its charter provisions give it authority to engage in a great variety of enterprises. For these and other reasons it is felt that the development of the industries of the country will be continued as aggressively as circumstances allow.

On the other hand, although the writer is convinced that the possibilities of the country are great, its limitations should be fully appreciated. The country is new and needs to be opened up. Few of the people understand what is needed if industries are to prosper, fewer still have had the experience of promoting a new corporation, and, although it would appear that a certain amount of capital is hoarded among the people, only a few men have succeeded in attracting it into legitimate industries. Labor is unfamiliar with machinery, good mechanics are very scarce, and native mechanical engineers are practically unknown.

FUEL.

The fuel situation in the Philippines is very serious for the industries there. In 1914 coal prices in Manila, for industrial purposes, were in the neighborhood of $4 per ton. In March, 1919, the writer was given data regarding an important order that was placed at $31.10 per ton. The Archipelago requires about 600,000 tons per annum.

The amount of coal produced in the Philippines has been reported as follows:

	Metric tons.		Metric tons.
1907	4,123	1914	None.
1908	10,035	1915	None.
1909	30,336	1916	None.
1910	28,655	1917	5,748
1911	20,000	1918	15,663
1912	2,720	1919	32,892
1913	None.	1920	58,888

By far the largest part of the imported coal is from Japan. China and the Japanese-leased territory in China have also made important

shipments. Borneo, Indo-China, and Australia have supplied it from time to time. But the situation is very unsatisfactory. Coal has been found in the islands, but it has been difficult to produce it on a commercial basis. As mentioned above, the National Coal Co. has been organized in an effort to solve this problem and is understood to have produced the tonnage shown since 1916. It is to be hoped that it will prove an unqualified success. Petroleum traces have also been found. Possibly this will lead to a satisfactory fuel supply. At any rate, the importance of developing a fuel supply is fully realized. In the meantime it is not possible to estimate what the future cost of coal will be, but probably it will continue to be expensive. Wood and oil fuel also probably will be high in price. Equipment for use in the Philippines should be designed for high economy in steam consumption, and furnaces should be designed for maximum efficiency, suitable for operation on inferior coal of friable nature, high in volatile matter and high in ash, of chestnut size or smaller.

It may be of interest to note that in the early part of 1919 conditions were such that the Manila Electric Railway & Light Co. used copra cake as fuel to meet part of its steam requirements. Probably this will not happen again, as the cake is too valuable as cattle feed to be used in this way, but the incident illustrates the resourcefulness sometimes needed in Asiatic countries.

Because of the high price of coal other sources of power should be considered. Oil engines of many types are widely used, the customs returns of the United States showing that 7,056 internal-combustion engines were shipped to the Philippines in the years 1914 to 1921, inclusive. In addition, a considerable number of such engines were imported there from Europe. Of these there are a great many gasoline and kerosene engines of moderate size for stationary, portable, and marine services. For larger installations the hot-bulb or semi-Diesel type is used, and there are a few installations of true Diesel engines. American manufacturers would probably be wise in paying closer attention to the possibilities of gas engines, especially of the suction-gas type, as the high cost of coal and oil makes the gas engine unusually economical. Coconut shells make an excellent charcoal for such use, and there are many other vegetable products that might be considered. Such units should have producers of exceptional size, but, when properly designed, they give satisfaction, and the operating costs are very attractive under the abnormal local conditions—a fact supported by experience in the Federated Malay States as reported heretofore. One gathers the impression that European manufacturers obtain a larger proportion of the business in Diesel, semi-Diesel, and gas engines than the circumstances of the situation justify.

If the industrial development of the country were more advanced, one would expect that the above conditions would stimulate hydroelectric development in such a mountainous country. No accurate survey has been made of available water-power sites, but the total applications for water-power rights since the American occupation and up to November, 1918, amount to 237,000 horsepower. Up to the same date the developed water power was 2,280 horsepower in six plants. It seems probable that there will be further development

along hydroelectric lines, the rapidity of which will depend upon a number of rather complicated conditions.

POSITION OF AMERICANS IN THE MARKET.

More than 80 per cent of the industrial machinery imported into the Philippines is from the United States. There are a number of reasons for this comparatively favorable showing, and, also, it is felt that in some lines Europeans still secure more business than the merits of their goods and other conditions justify.

Apart from the influence of Americans and American investments, the good steamer connections with the United States and the mail, telegraph, and banking facilities, the tariff operates in favor of American products. American machinery is admitted free of duty, while that from other countries pays from 10 to 35 per cent, according to its classification. It seems best to quote those sections of the law that refer to machinery.

Section 4 of the United States tariff act of October 3, 1913, concerning tariff relations with the Philippine Islands provides:

C. That there shall be levied, collected, and paid upon all articles coming into the United States from the Philippine Islands the rates of duty which are required to be levied, collected, and paid upon like articles imported from foreign countries: *Provided*, That all articles, the growth or product of or manufactured in the Philippine Islands from materials the growth or product of the Philippine Islands or of the United States, or of both, or which do not contain foreign materials to the value of more than 20 per centum of their total value, upon which no drawback of customs duties has been allowed therein, coming into the United States from the Philippine Islands shall hereafter be admitted free of duty: *Provided, however*, That in consideration of the exemptions aforesaid all articles, the growth, product, or manufacture of the United States, upon which no drawback of customs duties has been allowed therein, shall be admitted to the Philippine Islands from the United States free of duty: *And provided further*, That the free admission herein provided of such articles, the growth, product, or manufacture of the United States, into the Philippine Islands, or of the growth, product, or manufacture, as hereinbefore defined, of the Philippine Islands into the United States, shall be conditioned upon the direct shipment thereof under a through bill of lading from the country of origin to the country of destination: *Provided*, That direct shipments shall include shipments in bond through foreign territory contiguous to the United States: *Provided, however*, That if such articles become unpacked while en route by accident, wreck, or other casualty, or so damaged as to necessitate their repacking, the same shall be admitted free of duty upon satisfactory proof that the unpacking occurred through accident or necessity, and that the merchandise involved is the identical merchandise originally shipped from the United States or the Philippine Islands, as the case may be, and that its condition has not been changed except for such damage as may have been sustained: *And provided*, That there shall be levied, collected, and paid in the United States upon articles, goods, wares, or merchandise coming into the United States from the Philippine Islands a tax equal to the internal-revenue tax imposed in the United States upon the like articles, goods, wares, or merchandise of domestic manufacture; such tax to be paid by internal-revenue stamp or stamps to be provided by the commissioner of internal revenue, and to be affixed in such manner and under such regulations as he, with the approval of the Secretary of the Treasury, shall prescribe; and such articles, goods, wares, or merchandise shipped from said islands to the United States shall be exempt from the payment of any tax imposed by the internal-revenue laws of the Philippine Islands: *And provided further*, That there shall be levied, collected, and paid in the Philippine Islands upon articles, goods, wares, or merchandise going into the Philippine Islands from the United States a tax equal to the internal-revenue tax imposed in the Philippine Islands upon like articles, goods, wares, or merchandise of Philippine Islands manu-

facture; such tax to be paid by internal-revenue stamps or otherwise, as provided by the laws in the Philippine Islands; and such articles, goods, wares, or merchandise going into the Philippine Islands from the United States shall be exempt from the payment of any tax imposed by the internal-revenue laws of the United States: *And provided further*, That in addition to the customs taxes imposed in the Philippine Islands there shall be levied, collected, and paid therein upon articles, goods, wares, or merchandise imported into the Philippine Islands from countries other than the United States, the internal-revenue tax imposed by the Philippine government on like articles manufactured and consumed in the Philippine Islands or shipped thereto for consumption therein from the United States: *And provided further*, That from and after the passage of this act all internal revenues collected in or for account of the Philippine Islands shall accrue intact to the general government thereof and be paid into the insular treasury.

It will be noted that it is important to demonstrate to the customs authorities when goods are of American origin. This is done by means of a "certificate of origin" described more fully elsewhere. Failure to have such a certificate usually results in serious expense in the form of duties, fines, or delays, according to circumstances.

The duties paid on machinery from other countries are:

Typewriters, mimeographs, Roneos, and other writing, duplicating, and manifolding machines and devices, adding machines, comptographs, and other computing apparatus, fare registers, and detached parts for any of the foregoing, including ribbons, pads, stencil sheets, mimeograph silks, and similar accessories therefor, and stamp pads, 15 per cent ad valorem.

Cash registers and detached parts therefor, 25 per cent ad valorem.

Sewing machines and detached parts therefor (except needles), 15 per cent ad valorem.

Automatic slot machines, not otherwise provided for, and detached parts therefor (subject to the provisions of section 3 of this act), 35 per cent ad valorem.

Machinery and apparatus for weighing and detached parts therefor, not otherwise provided for, 20 per cent ad valorem.

Electric and electrotechnical machinery, apparatus, and appliances:

(*a*) Dynamos, generators, generating sets, alternators, motors, and similar machinery, not otherwise provided for, transformers and storage batteries, switchboards and switches, arc lamps, telephone and telegraph instruments, fans, buzzers, and annunciators, ammeters, voltmeters, wattmeters, and similar measuring apparatus, dry and wet batteries, and detached parts for any of the foregoing, and articles used exclusively in the installation thereof, insulators and insulating compounds and materials used exclusively for electrical purposes, carbon, and incandescent bulbs and tubes, 10 per cent ad valorem.

(*b*) Cooking and heating apparatus and utensils, chandeliers, desk and table lamps, flatirons, soldering and curling irons, thermocauteries and cauterizing instruments, surgical, dental, and therapeutic appliances, including so-called electric belts, X-ray machines, vibratory apparatus, electroplating outfits, cigar lighters, other instruments, implements, utensils, and articles used in connection with, for, or by the application or production of electrotechnical, thermoelectric, galvanic, or galvano-magnetic force, and detached parts for any of the foregoing, not otherwise provided for, 20 per cent ad valorem.

Engines, tenders, motors, steam boilers, pumps, and machinery, diving suits, common tools, implements, and apparatus; detached parts therefor; not otherwise provided for; shafting and gearing:

(*a*) Of iron, steel, or wood, 15 per cent ad valorem.

(*b*) Of other materials; emery cloth; 20 per cent ad valorem.

Machine belting of whatever material, 10 per cent ad valorem.

Fine tools, implements, and instruments of whatever material, used in the arts, trades, and professions, such as measuring instruments, micrometric gauges, mathematical and drawing instruments, manicure instruments (not pocket cutlery), watchmakers', jewelers', surgeons', dentists', engravers', carvers', glass cutting, and similar tools, instruments, and implements, any of the foregoing and detached parts therefor not otherwise provided for, 20 per cent ad valorem.

In the statistical tables at the end of this section are details showing the kinds and amounts of machinery imported from year to year and the countries from which this equipment came; from these it will be noted that in spite of the protection afforded American machinery by the above laws Germany and the United Kingdom were able to supply an important and increasing volume of machinery. The German participation was as follows:

Years.	Rice and grain cleaning machinery.	Flour-mill machinery.	Internal-combustion engines.
1909	$11,000	$1,000	$1,000
1910	13,000	3,000	5,000
1911	14,000	1,000	26,000
1912	11,000	7,000	40,000
1913	48,000	36,000	38,000

A tendency to revive this trade is seen in the more recent customs returns published at the end of this section.

Some very strange figures appear in the tables beginning on page 232. For instance, in 1915, a war year, the United Kingdom supplied a disproportionate share of steam boilers, furnishing more than the United States, and in earlier years it did nearly as well. It will also be noted that Sweden supplied $34,000 worth of oil engines in 1914 and 1915. It is very difficult to account for these shipments from European sources during the more recent years.

The Japanese returns also show some points of interest. Under the item "Electrical machinery" the Japanese figures for 1918 claim an export of 34,235 yen as compared with 3,814 pesos acknowledged by the Philippine customs, suggesting that the Japanese returns refer largely to supplies rather than "machinery." Similarly, the amount of "other machinery" shown in the Japanese returns for 1918 is largely explained by an item of 47,947 pesos' worth of oil-extracting machinery acknowledged by the Philippine returns, most of which, it is understood, was originally made in the United States, though Japanese manufacturers do export hydraulic presses. The total figure also includes 3,140 pesos' worth of pumps. Against the Japanese export figure of 4,063 yen's worth of printing presses the Philippines acknowledge receipt of only 848 pesos, suggesting that an important percentage of these "presses" were accessories of a nature that would scarcely be classed as "machinery."

But regardless of how it is analyzed, most manufacturers will find that the opportunity in this market lies in its expansion. Except in a very few lines, such as cigarette machines, steam boilers, rice machinery, and possibly oil and gas engines and one or two other lines, there is no need to overcome foreign competition, but the effort should be directed toward stimulating the demand from the territory. A great deal is possible in this direction. Conditions now favor such work. There has been a general awakening. Each class of equipment must be handled on its merits, but there are many who wish to duplicate the success of those who have made handsome profits from lumber, gold, coconut oil, and sugar, and hearty responses will come to the man who can indicate how this is to be done.

SPECIAL CONSIDERATIONS AFFECTING SALES METHODS.

At the risk of repeating what has already been stated in the general section of this report, it seems desirable to emphasize that equipment sent to the Philippines will probably be subjected to extreme heat, frequent and severe rains, excessive humidity, periods of relative dryness, typhoons, and white ants, and, if it is to be a success, it should be so made as to withstand the ravages and decay that these things produce. However, if equipment is sent to the extreme south, as in Mindanao and neighboring islands, it will be out of the typhoon belt and will escape the high winds and the worst effects of some of the other sources of trouble.

Special consideration should be given to the size and weight of package that can be handled when it is necessary to send large cases. So far as landing in Manila is concerned, any package of reasonable size can be delivered, but it becomes expensive if large enough to be penalized by the lift scales, applying to ocean freight and lighterage. In the city motor trucks up to 5 tons' capacity are available wherever suitable roads exist.

If the machinery is to be handled on the railway it should be remembered that this does not as yet connect with the piers. About a mile separates them. All lines of railway in the Philippines are of 42-inch gauge (except plantation lines).

If it is necessary to transship onto the "interisland boats," it should be remembered that these small steamers have small hatches—only 4½ by 4½ feet—and can not handle packages heavier than 7 tons. Also the facilities for landing and delivering cargo at and from the smaller ports are frequently limited, and special care should be exercised in advance whenever it is proposed to ship heavy and bulky packages to locations having such restricted facilities.

As explained in the general section of this report, it is always necessary to be sure to comply with the regulations of the customs at destination. In the Philippines there are several matters that require special attention. This whole subject has been covered very clearly in an article prepared by A. B. Cresop, general manager of the Luzon Brokerage Co., and published in the Manila Daily Bulletin. Even at the risk of repeating what has been mentioned before, we quote the following, as it covers the routine of shipping goods to the Philippines in a very concise way:

> If this information is carefully impressed on your shipping department, there will result a great saving to yourself and your clients in the Philippine Islands, in addition to the satisfaction that will be experienced by your Philippine connection, which is sure to secure for you additional business.
>
> It is a positive fact that merchants of the Philippine Islands have been caused the loss of many thousands of dollars through either the lack of knowledge regarding simple requirements of the Philippine government with reference to documents, or carelessness on the part of shippers in the United States.
>
> Customs regulations, especially those pertaining to documents required by the customs authority, are simple and, if followed by the shipper, no inconvenience or loss would be sustained by the importer.
>
> All merchandise imported into the Philippine Islands is delivered by the carrier to the collector of customs at the port of debarkation and is delivered by the collector of customs to the lawful owner thereof, who must present, to establish this ownership, a properly indorsed "negotiable bill of lading," and the collector of customs is responsible under bond to make delivery to such lawful owner.

It is therefore most important that the importer have in his possession, upon arrival of the merchandise, a properly indorsed bill of lading. Not having this, in order to obtain possession of his goods he is compelled, first, to state under oath that such bill of lading has not been received; and, second, in lieu of it, file a fidelity bond for the value of the goods, including freight and an additional 10 per cent.

These bonds must be furnished by a surety company recognized by the Philippine government, or cash. Individual sureties may be accepted, but the formalities, under the laws of the Philippine Islands, make this almost impossible. With one exception, it is hardly necessary to state what constitutes a negotiable bill of lading, and that is: Importers doing business in the United States and in the Philippine Islands very often consign goods to order, being of the impression that their office in the Philippine Islands may sign for their United States office. This can not be done unless a power of attorney is given for that specific purpose, a copy of which must be on file with the collector of customs. Bills of lading of this nature must be returned to the United States for their indorsement, thus necessitating bond for later production, properly indorsed.

It is very important that documents should accompany the shipments, either by the same steamer or a steamer which precedes the shipment. There is now being operated, established from the Pacific coast, a service from San Francisco to Manila, via Honolulu, direct, of 23 days. Undoubtedly, such a service will either leave Vancouver or Seattle. Obviously, documents which do not accompany these steamers will be from 10 to 15 days late, as the ordinary steamer is 30 days making the trip. In cases of this kind, where the documents do not accompany the steamers, bonds will always be required at not only an additional cost to the importer but a considerable confusion in effecting delivery, which must be made from the steamer's manifest, which gives only the packages in general terms.

In order to obtain delivery of imported merchandise into the Philippine Islands there must be filed with the collector of customs an entry, in duplicate, which must be accompanied by the bill of lading and two copies of invoices.

The tariff law pertaining to the Philippine Islands prescribes, under section 16, the following:

"SEC. 16. That all invoices of imported articles, goods, wares, or merchandise shall state the true value thereof in the currency of the place or country from whence imported, or if purchased, in the currency actually paid therefor, shall contain a correct description of such articles, goods, wares, or merchandise, with true numbers, weights, and quantities in the tariff terms of this act, and shall be made in quadruplicate and signed by the owner or shipper, if the merchandise has been actually purchased, or by the manufacturer or owner thereof, if the same has been procured otherwise than by purchase, or by the duly authorized agent of such purchaser, manufacturer, or owner."

These invoices may be in four forms:

(1) For dutiable merchandise, whether coming from the United States or foreign ports, where the value is more than $100 United States currency, the invoice must be presented to a United States consul, vice consul, collector of customs, or commercial agent of the United States of the consular district in which the merchandise was manufactured, purchased, or shipped.

(2) If the merchandise is of the growth, product, or manufacture of the United States as provided for in section 12 of the United States tariff law pertaining to the Philippine Islands:

"SEC. 12. That all articles the growth, product, or manufacture of the United States and its possessions to which the customs tariff in force in the United States is applied and upon which no drawback of customs duties has been allowed therein going into the Philippine Islands shall hereafter be admitted therein free of customs duty when the same are shipped directly from the country of origin to the country of destination: *Provided*, That direct shipment shall include shipment in bond through foreign territory contiguous to the United States. Said articles shall be as originally packed without having been opened or in any manner changed in condition: *Provided, however*, That if such articles shall become unpacked while en route by accident, wreck, or other casualty, or so damaged as to necessitate their repacking, the same shall be admitted free of duty upon satisfactory proof that the unpacking occurred through accident or necessity, and that the merchandise involved is the identical merchandise originally shipped from the United States, or its possessions.

as hereinbefore provided, and that its condition has not been changed except for such damage as may have been sustained."

A commercial invoice, having a certificate of origin made a part thereof and signed, shall be presented as prescribed by Customs Administrative Circular No. 626:

"PAR. 111. The original and duplicate invoices for merchandise, the growth, product, or manufacture of the United States, shall have the following certificate printed, written, typewritten, or stamped thereon:

"'I hereby certify that the above-described articles are of the growth, product, or manufacture of the United States, or its possessions, and that no drawback of import duties has been or will be claimed thereon, and that this invoice is true and correct in all particulars.'

"This certificate shall be signed on both original and duplicate invoices by the manufacturer, seller, or consignor of the merchandise, or by a duly authorized agent of such seller, manufacturer, or consignor, and both invoices (except for shipment by post) shall be mailed to the consignees of the merchandise for filing with the customs entry pertaining to the importation."

(3) Importation of foreign merchandise the value of which is less than $100. A commercial invoice without the consular certificate is sufficient.

(4) Importation from the United States where the value is less than $10 and the collector of customs is satisfied that the merchandise referred to is subject to "free entry" under section 12. The certificate referred to before is not required.

Many exporters in the United States seem to be of the impression that foreign goods which have been imported into the United States and paid duty upon their entry are "free of duty" upon importation into the Philippine Islands. This is not the case. All foreign merchandise imported into the Philippine Islands is subject to duty regardless of the fact that it may have paid duty upon entry into the United States.

One of the greatest sources of loss of the Philippine merchants on foreign merchandise imported from the United States is from the fact that importers in the United States will ship foreign merchandise together with domestic merchandise in one invoice and fail to make notation of this on their invoices, and in the majority of cases, even certify that the entire invoice is of American origin or manufacture. In cases of this kind, the importer is subjected to a fine of from one to five times the duty; in almost every case, at least the minimum is imposed. In addition to this loss caused to the importer, by oversight or carelessness on the part of the shipper, the shipper is naturally placed under suspicion and all importations coming from him are most carefully scrutinized.

It should not be necessary to call the shipper's attention to the necessity of proper packing. It is, however, a fact that shippers in the United States * * * do not seem to realize that their merchandise must travel many thousands of miles and in many cases be handled a number of times. Their shipping department is in the habit of making shipments to local points with one or two handlings, which does not require heavy packing. It is strongly recommended that, in all shipments where the contents are of any appreciable value, an export packing be used—in other words, a packing which is especially heavy, for foreign shipments.

Another very important matter is that of marking. Marks should be plain, in big letters. If stencils are used, they should be placed at least on two sides of a package. Ninety-eight per cent of unclaimed merchandise which is sold in the Philippine Islands annually, and which runs into thousands of dollars, is [unclaimed] because the marks have been rubbed off, or so mutilated that they can not be read, or because the merchandise has been packed insufficiently and can not be identified when it arrives in the Philippine Islands.

If the requirements referred to herein are carefully followed, it will certainly result in a greater volume of business for those shippers. Nothing will increase business more than the complete satisfaction of clients and the correctness of documents, and properly packed merchandise is probably the cause of more business than any other factor. When competition is keen, prices are about the same from one importer as another, and service alone will increase the business.

If there is any merit in all that has been said in recent years about the value of "service" in business, it is plain that punctilious attention to the matters mentioned by Mr. Cresop will pay. Failure in

this respect discredits the manufacturer and his countrymen not only in the Philippines but in all foreign markets.

BUSINESS OPPORTUNITIES.

Manufacturers of factory machinery are always interested in the establishment of new industries and should study carefully the nature of oversea investments of American capital, as some investments have no effect whatever upon the demand for American machinery, while others result in the purchase of important amounts of such equipment. The Philippine Islands need capital, and in some senses industrial development there has been delayed because it has been lacking. It is not possible here to show just what opportunities exist, but there are a great many projects where American capital can be employed profitably, and those in authority are reported to be sympathetic to such investments. Adequate banking facilities exist for normal requirements of this sort.

It may be of interest to add that under the law Americans can participate in Philippine enterprises or can conduct enterprises in the Philippines. Coal lands can only be leased in blocks up to 2,965 acres (1,200 hectares) each for a period not exceeding 50 years, but leases are renewable. A corporation may purchase land and may secure plantations of large area from private parties, but the law provides that public lands may only be sold in blocks of 2,530 acres (1,024 hectares) or less. Lumber concessions are controlled by the Philippine Bureau of Forestry. Of course special legislation may be invoked when it is felt necessary, and it is said that Americans can rely upon cordial treatment.

DISTRIBUTION—PROPOSED "FREE PORT" AT MANILA.

In planning an organization to cover the markets of Asia the problem sometimes arises as to where the manager for the Far East should have his office, or correspondingly where a distributing center could be established. This problem is felt with considerable force by those who manufacture supplies, belting, etc., and is illustrated by the tire manufacturers' problems in connection with the automobile trade. Certain important manufacturers maintain warehouses in perhaps a dozen different cities in the United States. The same need is felt in Asia but with the further complication that "nationalism" is injected.

The subject is also associated with the "free-port" idea, which is that of having an area in which to relieve certain reexport cargo of the restrictions imposed by the collection of customs duties. Hamburg is a free port, and it is felt that much of its prosperity grew out of this fact. London, in a free-trade country, has a business similar to that of a free port, and much of its prosperity is derived from its consignment market.

In the Far East the British have free ports at Singapore and Hongkong, as well as elsewhere, which are used as distributing centers for the markets of Asia. The Dutch use Batavia and Soerabaya as distributing centers. The Japanese distribute largely from Kobe, and freight rates are so adjusted as to make this economical. It is

said that the Germans plan to develop Macassar in Celebes (a Dutch island) to meet their requirements.

It must be remembered that a "free port" is not necessarily free of all restrictions and control. For example, at the moment, American dyes are free to enter Hongkong but can be reexported from there only under license, and the formalities in this connection require the merchant to tell more about his trade than he would ordinarily care to do. Several other ports suffer from disadvantages that are largely the result of discrimination arising, more or less, from the nationalism of their populations. The circumstances of each particular business will control the location of the distributing center, and Kobe, Shanghai, Manila, Hongkong, and Singapore might all be given more or less consideration, depending upon the circumstances. It seems desirable to call attention to the advantages Manila has in this connection.

There is printed, opposite this page, a map showing how Manila lies in the Orient, and the distances to the principal ports are indicated. Most steamers leaving the Pacific coast for Japan and China ports go to Manila. Ships running from Australia to Japan usually call at Manila. Vessels from San Francisco to Calcutta call at Manila, Singapore, and Saigon. Japan and China have about four steamers a month from Manila, or more, depending upon the port considered. Indo-China has one or two ships a month, usually to Saigon. For Hongkong there are about eight sailings a month. British India, the Dutch East Indies, and Siam are reached via Singapore at least once a month.

It should be recognized that any such statements are necessarily incomplete because the shipping of the world is undergoing great changes. It has been suggested that Manila may have a more favorable freight rate than the other ports of Asia, as well as direct service. Shipping facilities will increase rather than decrease. Also, there is talk of providing Manila with a free port.

A good basis for such a trade exists, as is shown by the volume of the Asiatic commerce of the Philippine Islands in 1920:

Countries.	Imports from—	Exports to—	Total.
Japan	$16,089,115	$7,443,020	$23,532,135
China	10,743,762	2,259,277	13,003,039
Hongkong	537,269	6,942,838	7,480,107
French East Indies	4,678,143	435,299	5,113,442
British East Indies	2,870,070	1,952,653	4,822,723
Dutch East Indies	2,399,060	363,095	2,762,155
Siam	4,314,948	51,777	4,366,725
Total	41,632,367	19,447,959	61,080,326

Remembering, as has been stated before, that Manila absorbs more American machinery than any other Asiatic port (except Yokohama and Kobe, which could scarcely be used as distributing centers) and also gives promise of increasing both in absolute and relative importance, one concludes that this would probably be the most desirable location from which to supply the markets of Asia. A considerable business of this kind has already been done, as is

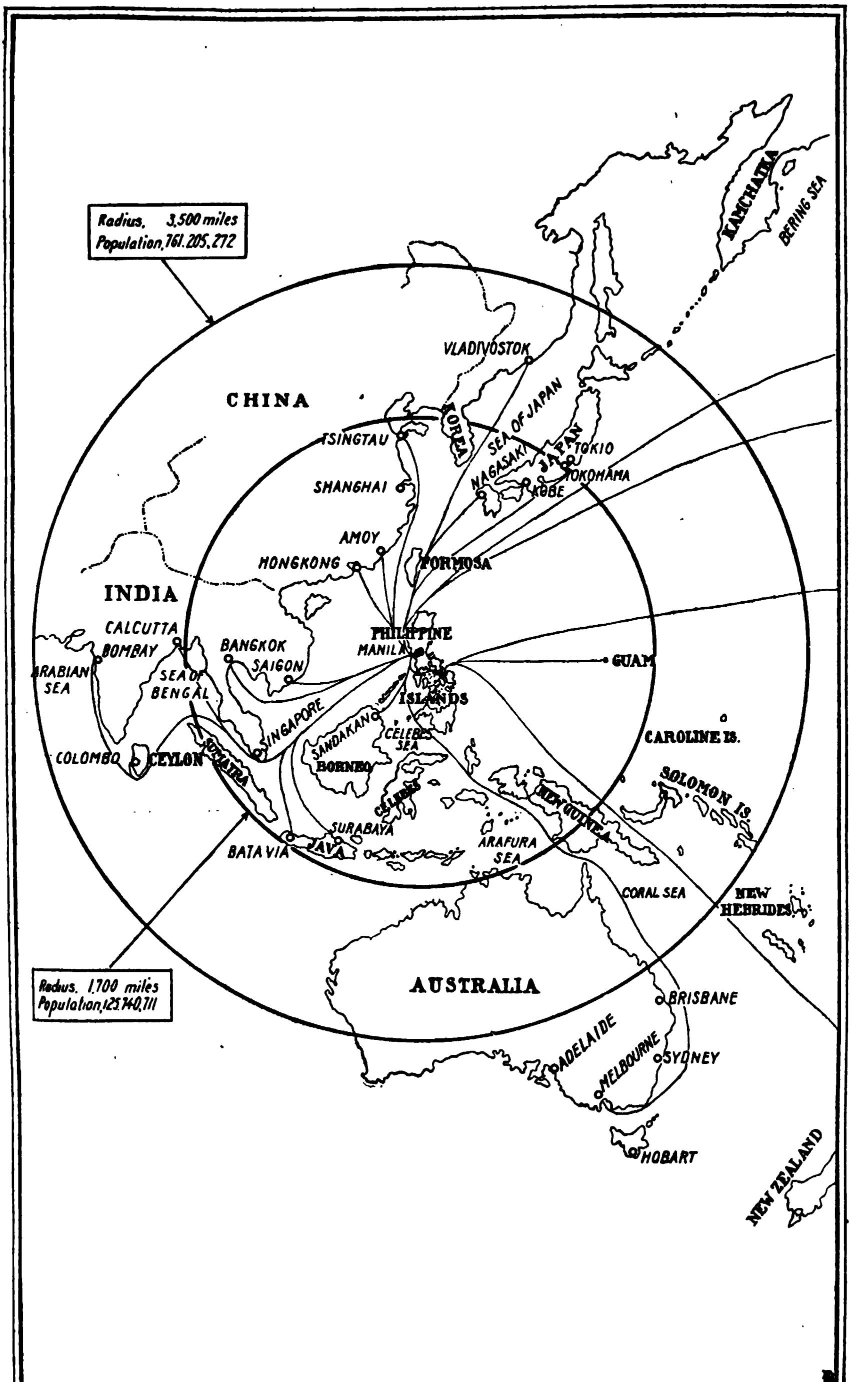


FIG. 27.—Map showing possibilities of Manila as a distributing center.

shown by the following data covering "American merchandise re-exported," from the returns of the Philippine customs:

Countries of destination.	1915	1916	1917	1918	1919	1920
French East Indies	$21,997	$64,146	$314,693	$1,001,867	$392,285	$305,232
Hongkong	33,305	168,621	340,015	627,788	699,510	471,407
British East Indies	26,070	32,294	52,481	258,058	495,497	648,777
Dutch East Indies	23,246	63,563	82,596	178,716	80,704	179,381
China	21,521	96,792	101,447	81,945	1,412,076	344,156
Japan	8,836	129,720	175,089	64,665	194,598	121,794
Siam	366	1,469	242	13,387	740	775
Total	135,341	556,605	1,066,563	2,226,426	3,275,410	2,071,522

The rapid growth and volume of this commerce suggests that there is real merit in the claim that Manila possesses superior advantages as a trade center. Unfortunately, the present facilities at Manila probably make the handling of this business more expensive than is really necessary. It is to be hoped that it will be possible to overcome these obstacles.

DETAILED STATISTICS OF MACHINERY TRADE.

The table below shows the imports of industrial machinery into the islands (according to the returns of the Philippine customs), converted into United States currency at the rate of 1 peso=$0.50:

Classes.	1914	1915	1916	1917	1918	1919	1920
Cigarette and other tobacco machinery:							
United States	$840	$15	$249	$913	$243	$28,152	$70,886
United Kingdom	4,041	3,839	2,507	1,084	3,654	1,829	1,355
France	15,727	3,973	4,047	7,472	2,007	28,337	35,565
Germany	2,152						5,560
Total	22,760	7,827	6,803	9,469	5,904	58,318	113,366
Electrical machinery:							
United States	63,652	108,885	43,476	60,740	133,748	533,456	365,779
United Kingdom	10,694	7,801	1,684	1,125	84	1,146	8,444
France	937						
Germany	28,823				75		2,861
Italy	847	270					
Spain			1,270			5,259	
Switzerland		22					
China						15	
Hongkong				287			
Japan			249	3,743	1,907	4,522	
Australasia		317					
Total	104,953	117,295	46,679	65,895	135,814	544,398	377,084
Fiber-stripping and baling machines and parts of:							
United States	6,200	6,964	6,603	2,305	27,200	110,875	52,121
United Kingdom	5,958		93	1,303	104		292
Germany	4,296	1,433					4,246
Hongkong		244					
Japan				3			312
Hawaii					675		
Spain					7,159		
Total	16,454	8,641	6,696	3,611	35,138	110,875	56,971
Metal-working machinery:							
United States	19,836	15,195	18,638	1,430	18,092	60,698	92,678
Hawaii				240			
United Kingdom	2,143	175	57			22	2,224
Germany	147						645
Hongkong		237					
Total	22,126	15,607	18,695	1,670	18,092	60,720	95,547

Classes.	1914	1915	1916	1917	1918	1919	1920
Mining machinery:							
United States	$57,052	$164,331	$34,059	$49,812	$29,729	$38,880	$36,639
United Kingdom			456	205	596		
Hongkong	492	297					
Australasia	23,624	1,626	5,983	569			
Germany						52,712	
Total	81,168	166,254	40,498	50,586	30,325	91,592	36,639
Entered for warehouse						52,712	
Oil-extracting machinery:							
United States	9,812	142,172	30,756	168,842	1,660,064	1,429,370	412,251
United Kingdom		2,463		284	64	197	4,500
China			6,978		2,456	1,016	1,516
Hongkong				579			
Japan				2,722	23,974	18,470	
Spain						108,985	
Hawaii						472	
Total	9,812	144,635	37,734	172,427	1,686,558	1,558,510	418,267
Pumps and pumping machinery:							
United States	30,365	31,596	38,897	46,115	68,291	200,850	181,582
Hawaii						50	50
United Kingdom	6,450	678	1,176	617	8	688	1,286
Germany	1,748		1	2,102			987
Netherlands	64						
China	6				189	121	391
Hongkong	36						
Japan		380	890	1,029	1,570	661	144
Australasia	35						221
Total	38,704	32,654	40,964	49,863	70,058	202,370	184,571
Entered for warehouse				320			
Refrigerating machinery:							
United States	29,416	15,356	13,039	4,059	10,367	36,740	14,665
United Kingdom	723						
Total	30,139	15,356	13,039	4,059	10,367	36,740	14,665
Rice threshers, hullers, cleaners, and parts of:							
United States	26,977	21,933	3,151	12,101	19,847	73,260	184,393
United Kingdom	4,816	10,351	623	2,122	96	312	3,143
Germany	65,990	2,943	1,615				14,232
Japan	17	2	6	106	61	938	
China					8		39
Total	97,800	35,229	5,395	14,329	20,012	74,510	201,807
Road-making machinery:							
United States	14,583	12,510	31,490	43,522	52,238	44,452	28,723
United Kingdom	140	226	511				26
Total	14,723	12,736	32,001	43,552	52,238	44,452	28,749
Steam and other power engines, parts of; locomotives, and parts of:							
United States	24,884	4,563	23,289	72,316	57,621	151,323	383,505
United Kingdom	149,853	69,576	6,017	2,082			16,351
Germany	60,089					63,750	
Spain	18						
Switzerland		44,628					
Australasia					5,694		13,421
Total	234,844	118,767	29,306	74,398	63,315	215,073	413,277
Entered for warehouse						63,750	
Stationary, marine, and parts of:							
United States	90,633	93,747	137,890	279,241	508,900	1,273,109	1,082,244
United Kingdom	46,512	25,691	21,484	21,289			7,618
Denmark				488			
Japan					122	2,148	922
France	13						
Germany	49,435	1,242		2,067			
China					1,231		
Sweden	19,465	14,805	2,642	97	246		9,751
Hongkong	115	121					
Australasia	200						

Classes.	1914	1915	1916	1917	1918	1919	1920
Stationary, marine, and parts of—Continued.							
Guam					$50		
Hawaii					7,300	$400	
Norway							$1,947
Total	$200,373	$135,606	$162,016	$303,182	517,849	1,275,657	1,052,482
Entered for warehouse	5,292			2,066			
Traction, portable, and parts of:							
United States	13,287	9,281	14,247	2,778	10,526	692,089	2,310,668
Hawaii						10,146	820
United Kingdom	15,529	2,256	837	103	155		
Germany	4,966						
Australasia							2,310
Total	33,782	11,537	15,084	2,881	10,681	702,235	2,313,798
Boilers, and parts of:							
United States	49,152	30,575	26,406	63,317	204,311	442,383	299,811
Hawaii						9,520	768
United Kingdom	41,673	30,699	17,451	6,406	1,311	213	1,252
Belgium	182						
Germany	44,615			2,582	4		
China			116				
Hongkong	249	3,169	179	743			3,681
Japan				16	4,087		46
Total	135,871	64,443	44,152	73,064	209,713	452,116	305,558
Entered for warehouse	5,000						
All other engines and parts of engines:							
Australasia							5,036
United States	7,892	7,765	11,660	64,327	220,071	199,239	334,710
Hawaii					300	100	
United Kingdom	763	2,375		1,353	326	1,705	101
Germany				5,040	100		3,989
Sweden				256			3,547
Hongkong	7	210	775	437	372		
Japan				130	475	113	98
Total	8,662	10,350	12,435	71,543	221,644	201,157	347,481
Entered for warehouse				255			
Sugar machinery:							
United States	98,009	55,915	71,992	257,392	383,802	1,445,318	1,000,287
Hawaii	22,374	1,680	4,430	65,701	71,809	1,928,031	1,386,796
United Kingdom	49,340	57,024	45,050	50,263	8,476	1,814	44,889
Germany	119						
Spain			3,053				
China					15		
British East Indies			62				
Hongkong	188						
Netherlands					5,387		
Total	170,030	114,619	124,587	373,356	469,489	3,375,163	2,431,972
Sawmill machinery:							
United States	81,484	20,161	39,125	74,840	37,130	60,472	
United Kingdom	17				77		
Germany	46						
Canada					1,029		
Japan					13		
Total	81,547	20,161	39,125	74,840	38,249	60,472	
Other woodworking machinery:							
British East Indies							9
United States	13,997	3,065	5,643	6,540	17,689	79,338	73,898
United Kingdom	406						
France	124						
Germany	546	9,829					
Switzerland		539					
Japan						947	
Total	15,073	13,433	5,643	6,540	17,689	80,285	73,907
All other machinery, machines, and parts of:							
French East Indies							55
United States	245,775	134,945	96,631	129,555	318,889	791,827	1,195,514
Hawaii	450	284		240	12	1,943	3,440
United Kingdom	61,473	14,699	14,753	17,564	13,594	15,769	33,225
Belgium	758						

Classes.	1914	1915	1916	1917	1918	1919	1920
All other machinery, machines, and parts of—Continued.							
France	$2,885	$133	$789	$26	$820	$484	$2,849
Germany	101,951	64	837	3,417	2,739	....	6,593
Italy	179	....	....		....	....	1,665
Netherlands	169	....	....	....	77	....	....
Spain	220	57	30	309	....	24	1,234
Sweden	10	7	31	47	....	....	....
Switzerland	18	....	73	44	....	....	442
China	319	586	2,905	7,399	7,005	9,797	3,749
British East Indies	84	120	204	....	492	....	2,496
Hongkong	2,311	2,176	3,412	5,269	2,239	3,846	1,792
Japan	2,728	916	755	15,456	8,680	4,231	3,957
Australasia	1,014	5,610	2,691	2,694	1,791	1,080	7,986
Canada	....	....	....	....	....	....	5
Total	420,344	159,597	122,611	182,020	356,338	829,001	1,265,004
Entered for warehouse	226	....	....	1,624	1,769	2,696	....

According to the foregoing figures, the percentage of machinery from the United States in the several years has been: 1915, 73 per cent; 1916, 80.3 per cent; 1917, 84.7 per cent; 1918, 95 per cent; 1919, 76.3 per cent; 1920, 83 per cent.

In the above table machinery from Hawaii has not been credited to the United States. Most of this equipment is sugar machinery. If this Hawaiian machinery be called American, the American totals become: 1915, 1,761,886 pesos (73.1 per cent); 1916, 1,303,350 (81.1 per cent); 1917, 2,812,719 pesos (88.9 per cent); 1918, 7,718,715 pesos (97.2 per cent); 1919, 19,239,799 pesos (95.5 per cent); 1920, 19,107,264 pesos (97.3 per cent).

The following table shows the exports of machinery from the United States to the Philippines, according to official American returns:

Classes.	1910 [1]		1913 [1]		1915 [1]	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery	....	....	....	2,460	....	14,090
Elevators and elevator machinery	....	....	....	5,184	....	24,055
Stationary gas engines	....	....	49	10,372	36	9,174
Gasoline engines:						
Automobile	....	....	1	300	....	....
Marine	....	....	39	9,302	91	20,137
Stationary	....	....	45	11,039	6	869
Traction	....	....	....	....	3	12,992
Steam engines:						
Locomotives	1	6,636	37	468,058	....	....
Marine	....	....	4	4,458	1	302
Stationary	39	11,930	24	19,864	1	283
Traction	1	2,610	11	46,466	....	....
All other engines	8	16,492	32	27,525	12	11,709
Parts of engines	....	63,559	....	76,786	....	54,502
Flour and grist mill machinery	....	....	....	11,505	....	32,670
Power laundry machinery	....	8,926	....	7,010	....	245
Metal-working machinery	....	8,933	....	5,824	....	13,640
Oil-well machinery	....	....	....	....	....	11,954
Other mining machinery	....	24,913	....	19,945	....	49,757
Pumps and pumping machinery	....	36,503	....	87,174	....	28,810
Refrigerating, including ice-making machinery	....	....	....	36,940	....	30,941
Shoe machinery	....	6,367	....	324	....	1,767
Sugar-mill machinery	....	....	....	183,259	....	39,340
Textile machinery	....	....	....	86	....	....
Sawmill machinery	....	....	....	18,814	....	11,484
Other woodworking machinery	....	16,780	....	10,124	....	4,060
All other machinery and parts of	....	328,712	....	427,017	....	316,781
Total	....	532,361	....	1,489,836	....	689,562

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery	....	40,307	....	65,482	....	68,932
Concrete mixers	....	1,202	....	32,361	....	7,563
Elevators and elevator machinery	....	50,307	....	18,227	....	69,758
Stationary gas engines	104	44,986	50	24,891	6	2,210
Gasoline engines:						
Automobile	6	2,585	19	4,034	7	3,753
Marine	447	316,169	337	120,307	66	42,338
Stationary	206	92,747	753	327,288	84	55,004
Traction	687	769,045	1,461	1,763,878	128	123,536
Kerosene engines	306	236,387	452	337,057	107	65,184
Steam engines:						
Locomotives	24	288,983	30	298,959	46	1,635,706
Marine	201	163,300	24	36,541	2	14,730
Stationary	89	186,433	168	198,642	11	73,274
Traction	72	119,239	51	95,760	33	39,665
All other engines	155	223,237	484	435,858	46	166,515
Boilers	....	379,898	....	278,004	....	159,259
All other parts of engines	....	657,079	....	594,009	....	419,623
Excavating machinery	....	95	....	2,727	....	60,839
Flour and grist mill machinery	....	14,417	....	7,948	....	2,821
Power laundry machinery	....	8,724	....	21,191	....	7,995
Lathes	....	91,749	....	102,905	....	29,880
Other machine tools	....	51,237	....	49,594	....	39,323
Sharpening and grinding machines	....	8,748	....	12,283	....	15,728
All other metal-working machinery	....	100,771	....	86,649	....	101,725
Oil-well machinery	....	222,789	....	141,150	....	32,833
Other mining machinery	....	64,210	....	58,238	....	34,507
Paper and pulp mill machinery	....	2,070	....	5,934	....	3,756
Pumps and pumping machinery	....	261,718	....	272,641	....	240,398
Refrigerating, including ice-making, machinery	....	23,006	....	98,697	....	52,031
Road-making machinery	....	40,657	....	49,566	....	2,416
Shoe machinery	....	18,556	....	14,886	....	8,489
Sugar-mill machinery	....	2,822,202	....	2,596,085	....	840,477
Textile machinery	....	17,232	....	44,216	....	2,743
Sawmill machinery	....	74,490	....	124,750	....	141,467
Other woodworking machinery	....	55,727	....	138,769	....	131,920
All other machinery and parts of	....	2,556,808	....	1,402,303	....	833,147
Total	....	10,007,110	....	9,861,830	....	5,529,555

The table below shows machinery exports from the United Kingdom to the Philippines. These British returns do not segregate the totals into the several items very clearly, but do give the following figures:

Year.	Total machinery.	Agricultural machinery.	Unenumerated prime movers.[1]	Unenumerated machinery.
1913	£139,041	£14,708	£16,111	£75,758
1914	96,306	2,122		26,493
1915	29,801	312	....	11,972
1916	33,960	2,629	....	14,039
1917[2]	[3] 19,755	....	11,510	12,248

[1] It is probable that these were largely Diesel oil engines.
[2] Subsequent returns were difficult to interpret.
[3] It should be noted that the figures for this year do not check; the reason for this discrepancy is not apparent.

Exports from Japan to the Philippines have been:

Classes.	1915	1916	1917	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Electrical machinery	3,897	11,479	20,325	34,235	43,000	44,000
Textile machinery	160	187	22,168	6,184	2,000	3,000
Printing machinery	....	112	....	4,063	....	....
Other machinery	5,541	4,679	23,647	73,955	23,000	21,000
Total	9,598	16,457	66,140	118,437	68,000	68,000

NOTE.—The yen is worth very nearly 50 cents United States currency, so is of almost the same value as the Philippine peso.

In 1918 the Philippine returns show only 3,814 pesos' worth of electrical machinery imported from Japan, suggesting that the above figures apply more strictly to supplies as distinguished from machinery. A like criticism applies to some of the other classifications.

CHINA.

GENERAL SITUATION IN MACHINERY MARKETS.

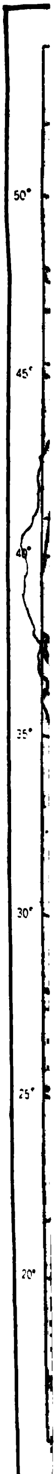
A general statement of the situation in the machinery markets China is presented in the following table, which was worked up fr the returns of the Chinese maritime customs and includes the impo at all of the 49 treaty ports extending from Aigun, Manchouli, Suifenho in the north to Yatung, Mengtze, or Szemao in the sout All these 49 ports are shown on the map opposite this page. T table shows the imports of industrial machinery into China:

Year.	Japan.	United Kingdom.	Per cent from United Kingdom.	United States and Canada.	Per cent from United States and Canada.	Total from all countries.	Exchange rate.[1]	Value of total in United States dollars.
	Haikwan taels.	*Haikwan taels.*		*Haikwan taels.*		*Haikwan taels.*		
1911	465,122	2,330,209	35.5	382,054	5.8	6,561,020	$0.65	4,323,1
1912	388,475	1,762,916	37.5	179,803	3.8	4,704,485	.74	3,481,3
1913	548,522	3,241,590	45.4	673,227	9.4	7,137,048	.73	5,210,0
1914	852,934	3,749,149	46.0	681,170	8.3	8,157,270	.67	5,465,3
1915	851,185	1,994,518	44.5	659,722	14.7	4,485,867	.62	2,781,2
1916	1,991,031	2,350,903	38.4	1,078,530	17.6	6,131,258	.79	4,843,6
1917	2,419,813	1,648,869	27.6	1,411,141	23.6	5,982,715	1.03	6,162,1
1918	3,569,909	1,313,604	16.7	2,390,332	30.4	7,860,290	1.26	9,903,9
1919	3,604,905	2,073,968	14.4	6,407,727	45.0	14,328,249	1.39	19,916,2
1920	3,727,604	5,229,026	23.2	12,181,382	54.1	22,536,254	1.24	27,944,9

[1] Value of the haikwan tael in terms of dollars.

It should be explained that these returns represent values originally stated in an arbitrary monetary unit called the haikwan tael which is used only for custom purposes but not for business pur poses of any other kind—a circumstance that has a very consider able influence on its exchange value. Theoretically the haikwa tael is 583.3 grains of pure silver. As a consequence, the value o this tael as expressed in gold units fluctuates rapidly and widely, depending in part upon the New York price for bar silver, but being somewhat influenced also by the trade balances not only of China but, to a certain extent, of all international trade. In making the above conversions it has been necessary to use the annual average value, but this may in fact differ a great deal from the value at the time when certain consignments were imported.

An attempt has been made to show the value of these markets to American manufacturers by indicating the amount credited to the United States by the authorities of the Chinese Maritime Customs. This is similarly inexact, as the shipments are always credited to the country represented by the last port of shipment, so that machinery transshipped at Hongkong or ports in Canada or Japan would be


50°
45°
40°
35°
30°
25°
20°

credited to those places, even though it originated in the United States. For example, 1919 returns credit Canada with $1,600,000 worth of textile machinery. Probably all of this equipment was made in New England and shipped via Vancouver. Inasmuch as the United States has supplied from 30 to 80 per cent of the machinery imported into Japan in different years and from 30 to 47 per cent of the machinery shipped into Hongkong, it is clear that the United States has supplied a good deal of machinery in addition to that strictly credited to it in the above statement. Additional details of these returns are presented farther on in this report.

While China absorbed only about $250,000 worth of American machinery in 1911 and $132,000 worth in 1912, it took about $16,000,000 worth in 1920, if we include an allowance for Hongkong and Japan transshipment consignments. It seems safe to infer that this larger volume of business will be reasonably well sustained, for 1911 was the year the old monarchy was overthrown by revolution. From what could be learned on the ground, machinery dealers anticipated that, as normal conditions were resumed, the trade would shrink from the high values of 1920, but would settle down on a basis of perhaps 60 per cent of that volume. This, of course, is a mere guess, but has value as representing the sentiment of persons in Asia.

It is most gratifying to note that in 1920 the markets of China were about sixty times as valuable to the American manufacturer as they were a decade ago. For many years the American engineer has been handicapped in these markets by a most unusual combination of circumstances, some of which were suggested by developments at the Washington Armament Conference, but the above figures show that he has now reached a position of most decided supremacy in this territory. It is obvious that the next few years will result in very keen competition in all of these Asiatic markets, so American manufacturers will be wise if they plan such sales compaigns as are necessary to maintain their present position. After a little time China may be expected to absorb increasing volumes of equipment and at least duplicate the record of 1920.

For the sake of completeness it should be noted that in 1917 and 1918, when the United Kingdom and the United States were fully occupied with the war, Japanese participation in the China machinery trade rose rather high, but has since been reduced. The record is as follows:

	Japanese percentage.		Japanese percentage.
1911	7.8	1916	32.5
1912	8.2	1917	40.5
1913	7.7	1918	45.5
1914	10.5	1919	25.2
1915	19.0	1920	16.5

The entire situation as shown by the returns presented on the preceding pages is shown clearly in Figure 29, but it should be noted that as this is plotted on a percentage scale it does not indicate the increasing value of the China markets as represented by the great increase in the volume of the imports during this period. Comparison should also be made with Figure 40 on page 286.

DIFFICULTY OF REACHING ACCURATE CONCLUSIONS REGARDING CHINA.

Since the days of Genghis Khan or earlier, the boundaries of China have been flung far beyond the area inhabited by peoples that are strictly Chinese, and imaginative writers, both modern and those of earlier periods, show a tendency to enlarge upon a very large subject. There is a tendency to speak of the "400,000,000 of China," to describe the amiable characteristics of the race, to refer to the vast areas in the country, and to enlarge upon the mineral resources, which, while known to exist, are a very uncertain quantity. But it is really astonishing how difficult it is to establish any fact, even the simplest, about the country. Apart from the excellent returns of the customs,

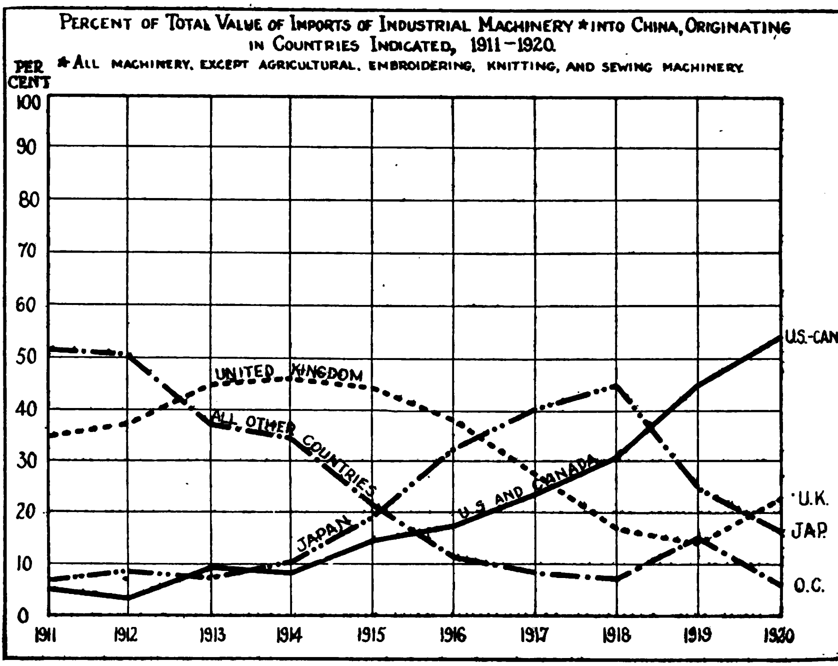


FIG. 29.

it is difficult to get any real statistics or to interpret such as are obtained. No one seems to know anything about even the population. For example, two different estimates of the population of Szechwan were made in 1913. One result was 23,000,000 and the other 78,711,000—and yet it is upon such data that we are told, without qualification, of the 400,000,000 people of China.

GEOGRAPHIC AND ECONOMIC COMPARISONS WITH UNITED STATES.

As shown on an ordinary map the boundaries include Mongolia, Sinkiang, and Tibet, the so-called "outlying territories," but these are negligible as a machinery market. Aside from these the remaining 21 Provinces are credited with an area of 1,896,495 square miles, which compares with 3,026,789 in continental United States. In

other words, these 21 Provinces have about the same area as the 38 States east of the Rocky Mountains. The agricultural resources of China are probably superior to those of this country. Its mineral resources are reported to be very good, but in reality no one knows a great deal about them. The western boundaries of these Chinese Provinces are walls of mountains even higher and rougher than the American Rockies. Beyond them lies the plateau of central Asia; much of this is reported to be arid and unpopulated, but as history indicates that vast populations have existed there, it seems probable that this aridity is exaggerated and that examination would show conditions resembling those in Kansas or Nebraska. In other respects China is most unlike the United States. In the whole country there are probably fewer miles of road that can accommodate a wheeled vehicle than could be found in even one county of Rhode Island. It is true that at one time China had a definite system of some 2,000 miles of roads, but these have been allowed to degenerate. The wear of traffic through the years and a total absence of maintenance (with the dust carried away by the winds or washed away by the rains) result in the gradual excavation of a channel that in time becomes a waterway in wet weather and soon becomes impassable for anything on wheels. The great caravan routes are very rough and rocky, all commodities are carried on the backs of animals or men, and the path is a very difficult one. In and out of Hongkong a motor car can operate over a total of perhaps 260 miles of road, which does not extend more than about 20 miles from the city; Canton has a corresponding total mileage of about 26, all of which is in the city and very new; Shanghai has a good mileage of fine roads, but these do not extend more than about 20 miles out from the city; Peking probably has the best system of highways, but, apart from a difficult dirt road to Tientsin, one can not get farther than Tungchow, about 16 miles out. All told, outside of the treaty ports, China in 1920 probably did not have more than 250 miles of road suitable for an automobile. Famine-relief and other organizations have since built perhaps an additional thousand miles of road north of the Yangtze.

Correspondingly, the total railway mileage is less than 7,000 as compared with more than 36,000 in India and 266,059 in the United States, and the railways that have been opened are not up to the American standard despite the fact that most of them operate through territory that is densely populated and the lines are assured a heavy traffic. Consequently, lack of transportation is a great obstacle to the trade of China and the territory is not to be compared with the United States. It is true that water transportation has been stimulated and that very heavy traffic exists on ocean, lake, and river and also on the remarkable system of canals, most of which have been in operation for centuries.

INADEQUATE TRANSPORTATION RESTRICTS MARKET.

Because of lack of transportation great areas and vast populations in China are beyond the reach of occidental commerce. The Province of Szechwan, mentioned above, is shut in by mountainous boundaries said to be 8,000 to 10,000 feet high; practically its only commercial traffic is on the Yangtze River, but as this must pass through the famous gorges and rapids it is dangerous and expensive and affected by the variations in water level. In fact, so far as

American trade is concerned, until better facilities are available it probably does not make much difference whether the population of Szechwan is 23,000,000 or 78,711,000, for, even if pig iron were available at $2 per ton or wheat at 15 cents a bushel in most parts of that Province or of Shansi, it could scarcely compete with the corresponding commodities from India, Europe, or the United States in the markets of Shanghai. It is true that two railways are planned that will reach Szechwan, and, when built, these lines are assured a very heavy traffic; but in the meantime trade is impractical. In 1919 Chungking and Wanhsien, the two cities in Szechwan that have been opened to foreign trade, absorbed industrial machinery worth 21,732 haikwan taels, out of the total of 14,328,249 for all China. Because of such conditions it seems safe to assume that there are not more than 200,000,000 people in China that can be reached by American or European commerce without undue expense, and this number will not be increased very much until the construction of new railways and highways opens up additional districts. This is the task of the next few decades.

RAPID EXPANSION OF CHINA MARKET—NECESSITY FOR CAUTION.

At the same time it should be strongly emphasized that the market in China is growing very rapidly, as is shown by the preceding figures and others published elsewhere in this report. The traffic on the railways is growing in a similar satisfactory way, and the mileage is being extended when the complicated conditions make this possible. In fact, there are distinct indications that important industrial expansion is at hand, as shown, for example, by the experience in the textile industry, to be referred to later; but it is also true that one should exercise caution in embarking upon ventures in China because conditions there differ radically from those in any other market of equal importance. The uninitiated will probably be inclined to assume that conditions in China resemble those in Japan and that the position of American machinery would be much the same in both cases. On the other hand, it will have been noted from figures given earlier in this report that in 1918 the United States supplied 80 per cent of the machinery absorbed in Japan but only 30.4 per cent of that taken by China. In other years similar discrepancies appear. It will be noted that this does not represent any difference in the engineering merit of the American equipment offered but is largely attributable to the influence of foreign loans and concessions in China. It will be remembered that nearly all enterprise in Japan is most definitely under Japanese control. In China a corresponding condition does not obtain. This subject will be considered more fully later.

RELATIVE DISTANCES AND ACCESSIBILITY.

The general size, shape, and proportions of the parts of China open to occidental commercé are apparent from the map published at the beginning of this section, and there has been superimposed upon it a map of the United States carefully drawn to the same scale in an effort to convey an idea of the areas and distances involved. If Peking were placed over the spot occupied by Chicago, it would be seen that the distance from Peking to Shanghai in miles is roughtly that from

FIG. 30.—CLOTH ROOM IN SHANGHAI COTTON MILL.

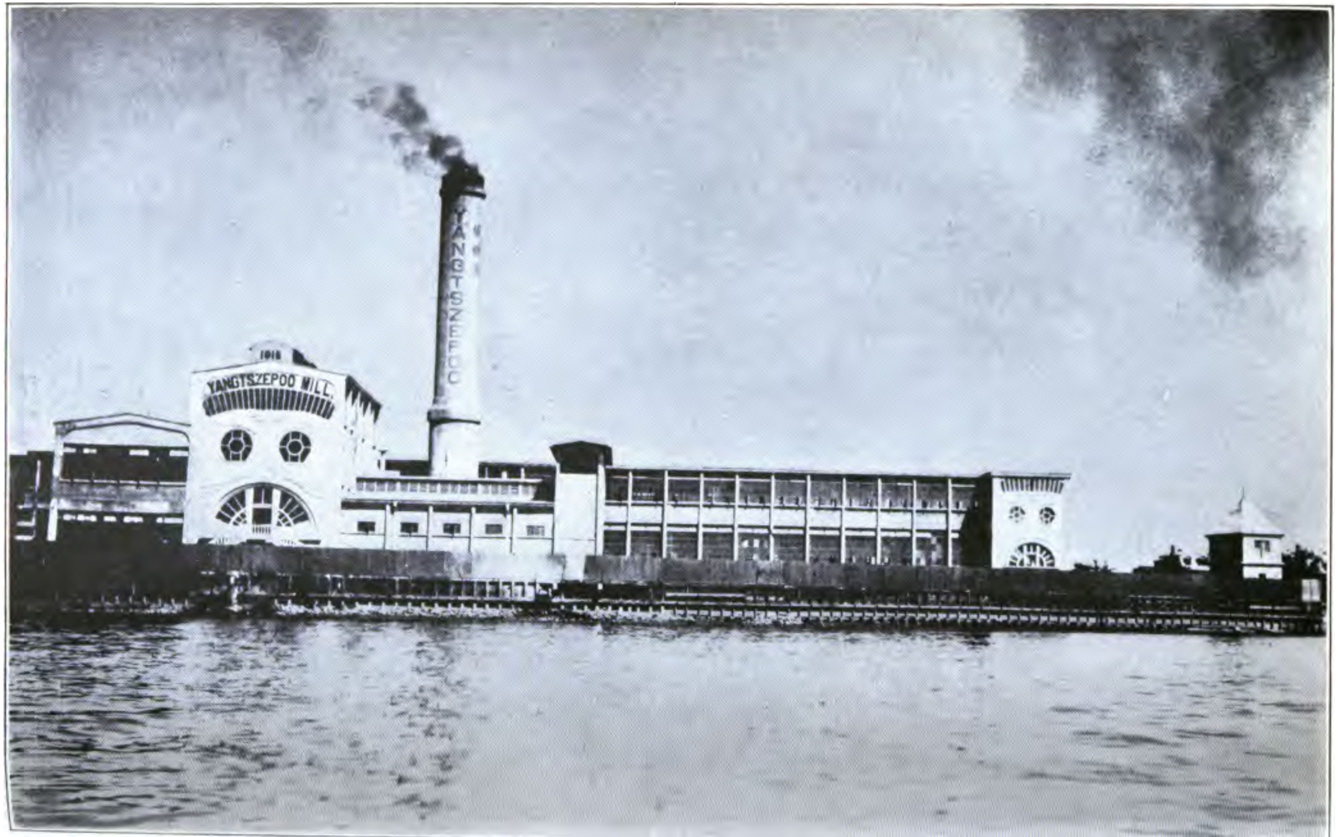


FIG. 31.—CHINESE COTTON MILL IN SHANGHAI.

Chicago to Charleston, S. C.; if measured by the time required to make the trip, it is somewhat farther. The distance from Chicago to New York is represented somewhat by that from Peking to Seoul in mileage, but the latter trip is circuitous and would require possibly double the time. The distance from Peking to Canton, it will be noted, is like that from Chicago to points well out in the Gulf of Mexico, nearly as far as the peninsula of Yucatan. Even the distance to Hankow corresponds to points south of the southern Tennessee boundary, and the Province of Szechwan (218,533 square miles), that one so often hears mentioned, is not much smaller than Texas (265,896 square miles). Possibly it would illustrate the situation to say that Szechwan resembles the condition that would exist in Texas if the population there were multiplied some 5 to 15 times and could only be reached by ascending the Rio Grande. Under these conditions what would it cost to deliver machinery by mule back to points in the "Panhandle"? At the same time the future prospects of Szechwan may be compared to those that might apply to Texas if under the above conditions surveys were being made for two different railways to reach Austin (Chengtu). Kansu (125,483 square miles) may be likened to Nevada (110,690 square miles), and is almost as inaccessible as Nevada would be if railways were no nearer than Kansas City. Yunnan, Kweichow, Shensi, and Shansi are also relatively inaccessible. China from the seacoast as far west as to include the area reached by the railways—say as far as a line passing a little west of Kalgan and Hankow and so south to Canton—is comparatively accessible by rail or water. A further study of this map affords a number of other interesting comparisons that give one an opportunity to estimate the distances involved.

EFFECT OF FOREIGN LOANS ON AMERICAN MACHINERY SALES.

In one way or another China has granted a great many concessions to foreigners, and these cover a great variety of interests. The earliest of these concessions included trading privileges and certain property rights in particular cities that came to be known as "treaty ports." In more recent years concessions have been granted covering the construction and operation of railways and the development of mines, and in some instances have included "leased territories," in which foreigners have exercised a considerable political control. The terms of these agreements have also shown great variety. In some instances the agreements have been what might be described as a simple treaty for trade and commerce. In other instances the arrangement involved the transfer of political control. The effect of these agreements upon American exports of machinery has been profound, because very few of these concessions have been in the hands of Americans, and the agreements secured by Europeans frequently included a clause to the effect that the materials required should be purchased in the country securing the concession or making the loan. An example of this kind has been mentioned on page 37 of this report. Other examples might be offered. One gathers the impression that the spirit of nationalism has been very strong and that in the selection of engineers, experts, and managers, as well as in the purchase of materials and equipment, merit, quality, and price have

often been subordinated to other considerations. A startling example of this is shown in the following quotation:

Another source of profit to the banks as well as to English industries was the provision which made the syndicate the purchasing agents of materials and rolling stock. Outside of the fact that the corporation was to receive on the average 5 per cent commission of the entire cost of all materials purchased, the materials were naturally almost exclusively purchased in England. Although all materials were nominally to be purchased in the open market, the usual clause that "at equal rates and qualities goods of British manufacture shall be given preference over other goods of foreign origin" provided an opportunity for almost exclusive purchase in England.[1]

The effect of such arrangements on American exports is obvious. But it should also be noted that this is not an isolated case and the method is not peculiarly British, for reference has been made to the fact that only German-made materials were to be used in Shantung. Correspondingly, other nationalities have arranged for the exclusive use of their products in other instances, and it is probable that no one of these nationals would claim to have a more extensive experience or a more perfect railway than is to be found in the United States. These clauses spring from other causes than mere technical superiority.

The importance of this situation is further increased by the fact that no one knows how many of these agreements are in existence. This situation was developed somewhat at the Washington Armament Conference in 1922. If one secures a concession for a railway, canal, or other project in China, there is a strong probability that, although issued in good faith by the Chinese authorities, it will be found to conflict with earlier unrecorded agreements, as shown by the following quotation:

It is practically impossible to make a complete statement of the engagements which have been entered into by China with foreign powers or with their nationals. In the first place, there is the difficulty that presents itself when dealing with the diplomacy and international relations of any country, that none of the Foreign Offices of the world have been willing to publish in full the correspondence between themselves and their diplomatic representatives stationed abroad, and that even the portions of such correspondence finally made public often appear only years after the dates they bear. And, even as to the treaties themselves, as is well known, many agreements exist that are known only to the parties signatory to them or to their allies. * * * But in the case of China's international relations the peculiar difficulty confronts the student that there are many instances in which China has committed herself, in writings or even conversations of a most informal character, which have not been recorded or made public, and which are only presented when the party claiming under them a beneficial interest deems the time opportune for doing so; still further, that in many, if not in most, of these cases, the State of China has been held bound by promises which have been made, or are alleged to have been made, by individual Chinese officials upon their own personal responsibility.

As an illustration of this, we may take the following extract from a newspaper statement by Mr. W. F. Carey, head of the American Siems-Carey Co., in which he describes some of the difficulties with which he had to contend in the attempt to locate the railways for the construction of which his company had obtained concessions from the Government of China. After speaking of having overcome obstacles imposed by the "spheres of interest" of the different nations, he found that he had still another bridge to cross. He says:

"Shortly after we secured the concession for this line and commenced our active surveys thereon, the British protested to the Chinese Government on the ground that in 1910 a certain Gov. John, of the Provinces of Honan and Hupeh, had written to a British consul stating that, in appreciation of

[1] "Foreign Financial Control in China," by Overlach, pp. 59 and 60. See also the Hukuang Railway Loan agreement signed May 20, 1911.

assistance rendered by the latter in securing a loan, the governor thereby granted to certain British interests the privilege of furnishing any funds that might be required in the future for railway construction throughout the aforesaid Provinces. While I have no personal knowledge of the details culminating in this transaction, I am satisfied that the alleged concession constituted the basis of the assistance rendered by the British interest in the premises." "In order to become valid," Mr. Carey continues, "according to Chinese law, this document should have had the sanction of the throne, for at that time China was an empire."[2]

Because of these and other circumstances it is necessary to make certain mental reservations in considering the extent to which Americans have participated in the machinery trade of China in the past and may be expected to participate in the future, particularly as compared with participation in other markets, and corresponding allowances should be made by those preparing plans for additional sales effort there. The concessions referred to above include not only railways, but also mines, cables, wireless, and other utilities, etc., and there are many directions in which such influences can make it difficult to sell American machinery.

The concessionaire spirit indicated above tends to develop in two distinct directions which are antagonistic. One of these may be called the imperialistic direction, and its spirit is shown in the following quotation from W. W. Rockhill: "It seems clear to me that so long as we shut our eyes to the undoubted fact that, in the East at least from Stamboul to Tokyo, politics, finance, and trade go hand in hand, and that neither the profits of trade can be fully reaped nor our influence and prestige be adequately upheld without incurring the responsibilities incident to political and financial activity, we must be content to play a modest, effaced rôle in the Far East, unworthy, in my opinion, of our great country and its vast interests in the Pacific."[3] The position advocated in this statement has always been repugnant to the American people. The other direction in which this concessionaire spirit sometimes appears to drift is toward the so-called "cosmopolitan finance" whereby the bankers of the several nations join financial interests. This neutralizes the nationalistic spirit of the "political finance" and "peaceful penetration by railway and bank" of individual nations and is sometimes felt to reflect upon the patriotism of the financiers who, in this way, conduct their operations independently of the imperialistic ambitions of certain of their associates. Events are moving rapidly in China, and it is idle to drift into prophecy. But Americans who are interested in foreign trade should give careful consideration to the ambitions of other nations and their inclination to employ finance—sometimes American capital—as a "weapon of offense and defense," as a "national source of strength" to extend the political as well as the material interests of such countries to the disadvantage of American trade and industries in the world's markets.

CURRENCY PROBLEMS.

Other conditions in China interfere with industry and trade, making ordinary business transactions difficult and expensive. One

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[2] "Foreign Rights and Interests in China," by W. W. Willoughby, pp. 344. Other instances are also cited there. An interesting article on the loan situation in China appeared in London "Engineering," Sept. 5, 1919, p. 314.
[3] Far Eastern Review, Vol. II, p. 229.

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of these is the present condition of the Chinese currency. Until recent years there have been many different monetary units in common use, various taels and dollars being given a certain amount of recognition, but practically all being based on the bullion value of the silver contained. One author has pointed out how in one town at least 60 currencies are possible.[4] But this applies only to what might be considered the domestic problem. In addition there is a constant fluctuation in the rate of exchange between the different cities. "Bank notes issued by a British bank in the colony of Hongkong have been, at different times during the past six or seven years, both at about 10 per cent discount and at 15 per cent premium in Shanghai at the branch office of the same bank."[5] These fluctuations are a very severe business handicap.

It is true that a very definite effort has been made toward currency reform by issuing the Yuan dollar, and where this is used it facilitates trade very much, but the reform has not yet been made complete and half a dozen or more different dollars are commonly in circulation in any one of the leading cities of China. Furthermore, the subsidiary coinage, silver and copper, circulates on a bullion basis, having entirely lost its token value. For example, one commonly receives 13 coppers for a dime and 11 dimes for a dollar or, again, 143 coppers for a dollar. Finally, as a truly oriental contradiction, there is a paper currency which has a series of values peculiar to itself. Added to all of this is the difficulty of converting large sums from an occidental currency into Chinese units, involving the transfer from gold to silver and into the necessary form of dollar or tael at the particular city involved. These conditions encourage speculation in exchange, which, again, tends to make trade hazardous and expensive. Heavy losses or profits on exchange are a regular feature of trade in China, and many serious business failures have been the result during recent years.

PROSPECTS OF THE MARKET.

Figures have already been presented that demonstrate that in the three years 1918, 1919, and 1920 China absorbed more than $37,000,000 worth of American industrial machinery. They also show that the demand for such equipment is developing consistently and rapidly. American machinery is more than introduced into China; it has an established position there. Also, there is a feeling that this trade will develop enormously:

> A director of one of the great Japanese steamship companies recently said, "The Chinese are great buyers, but what they are buying to-day is but a bagatelle of what they will buy to-morrow." The industrial era is just commencing in China. All over China the natives are demanding electric light. Lamps and accessories are coming from Japan and Britain. The Chinese are demanding railways; they have in a few years enormously extended the postal and telegraph systems. The vast plains of Manchuria have trembled beneath the steel of the steam plow; the rivers re-echo to the noise of steamers and motor boats. Mining machinery has been already imported into China, but the possibilities of this market are beyond description. Modern mining work inevitably means electric power.[6]

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[4] "Trade and Administration in China," by H. B. Morse, p. 145.
[5] "The British in China," by C. A. Middleton Smith, p. 64.
[6] "The British in China," by C. A. Middleton Smith, p. 74.

There is something in this situation that appeals most strongly to the imagination—the vast area, the abundant population, the splendid natural resources, both mineral and agricultural, the potential water power, all in the hands of a people who are intelligent, clever, hard working, dependable, and likable, most of whom are forced to a low standard of living but will demand more as soon as it can be obtained. And it is so easy to enlarge upon the consuming capacity of 400,000,000 people. Almost every foreigner feels this same situation on visiting China. There is something almost hypnotic about it. But because of just this situation the business man should be especially careful in making plans for the expansion of his trade there. The fascination of present prospects can easily result in exaggerating the value of the market. "Every traveler in every part of China is astonished at the quantity and variety of the merchandise which is constantly on the move. It is this that inspires confidence in the boundless potentialities of Chinese commerce, which only seems waiting for the link of connection between the resources of the Empire and the enterprise of the western world."[7] These words were written by an Englishman before 1900 but express the feelings of all Europeans since the beginning. Marco Polo saw the same thing, and his reports were so glowing as to inspire the voyages of Columbus, but the world still awaits this awakening. Because of this feeling that possibly next year something will magically establish the contact between East and West and expand this trade, it is most necessary to be conservative about establishing a large business organization in China, for there are forces at work that still postpone the day so long anticipated. There is a very great danger, in business in China, of looking forward too far. Often we are reminded of the enormous volume of the trade that will develop during the next few decades, and undoubtedly it is true that such development will occur, but because of the uncertain aspects of the situation it is most desirable that attention be confined to the immediate future. The statistics presented herein show most clearly what has been done and thereby suggest what is to be expected in the immediate future. If a project will not develop during the next five years, it will be well not to rely on the ensuing decades. The market is very important, and the future is very promising and well deserves businesslike attention.

SUBDIVISIONS OF THE TERRITORY.

From the point of view of the machinery business China divides itself into three great markets. The most northerly section is Manchuria, made up of three Provinces. For this region Dairen is the principal distributing center, although some equipment enters through Antung, where the railway crosses the river from Korea; also some equipment is taken in through Suifenho, where the railway from Vladivostok crosses into Manchuria. The central section, sometimes called North China, comprises the whole vast area supplied through Tientsin and Shanghai and includes all of the treaty ports from Chinwangtao to Santuao. The third large section is usually called South China and is supplied very largely through Canton (Hongkong), but includes that section of the country from Foochow south.

[7] "The Englishman in China," by Alexander Mitchie, vol. 1, p. 209.

SOUTH CHINA.

TOPOGRAPHY AND COMMUNICATIONS.

This South China district is almost as completely separated from the general machinery markets of the rest of China as if it were a separate country, for there is a range of mountains that cuts it off from the Yangtze Valley almost completely. From the Province of Yunnan these mountains turn eastward under the names of Manling, Meiling, Wuling, Fengling, and other local designations, and passing through the Provinces of Kweichow, Hunan, and along the boundary between Kwangtung and Kiangsi, and also between Fukien and Kiangsi, reach the sea a little north of Santuao at about 27° north latitude. This mountain barrier is so real that practically no commerce crosses it, and to reach Canton from Shanghai involves about a four-day sea voyage, or much the same as reaching New Orleans from New York (without using railways, which are not available for the particular journey in China that has just been mentioned). The district south of these mountains includes the Provinces of Yunnan, Kwangsi, Kwangtung, and parts of Kweichow, Hunan, Kiangsi, and Fukien—altogether an area of perhaps half a million square miles, a grouping that might compare with the States of Florida, Georgia, Alabama, Mississippi, Louisiana, and Texas. The population of South China has been estimated to be about four or five times as great as that of the States just mentioned.

In all this vast district there are only 681 miles of railway in operation, and this mileage is largely made up of short, disconnected lines. From Amoy is a line 18 miles in length. From Swatow is a line 26½ miles long. The most important stretches are near Canton, especially a line of 140 miles that is started toward Peking. The northern part of this Peking-Canton system is complete and carries a heavy traffic, but there is a section from Shiuchow to Chuchow, about 306 miles, still incomplete, and as this is the part that must cross the Wuling Mountains it will be a difficult and expensive section to build. It has been estimated that in the 69 miles still to be built in Kwangtung Province there will be 60 tunnels, totaling 10,000 feet, and the cost of these 69 miles will be about $9,000,000. Also from Canton there is a line of 112 miles to Kowloon, opposite Hongkong, and a line of 32 miles to Samshui. Near by is a disconnected section of 63½ miles from Kongmoon to Samkaphoi. The only remaining railway is far away in Yunnan, a mountainous region reported to be rich in minerals, and consists of a 289-mile stretch of meter-gauge line which was built under French auspices and reaches the sea at Haiphong, through the French railways in Tongking (part of Indo-China). It should be remembered that French goods passing through Indo-China to Yunnan on this railway are exempt from Indo-China import duties, while other goods passing through are taxed 20 per cent of the regular import tariff. French and Indo-China goods pay about 20 per cent less for freight than does merchandise from other countries. These provisions have a decided influence on the foreign trade of Yunnan.

From the above it is clear that in South China we have an area as large as that part of the United States that can be reached from the Gulf of Mexico, with abundant population, comprising a district of wonderful agricultural resources and reputed, with the exception of

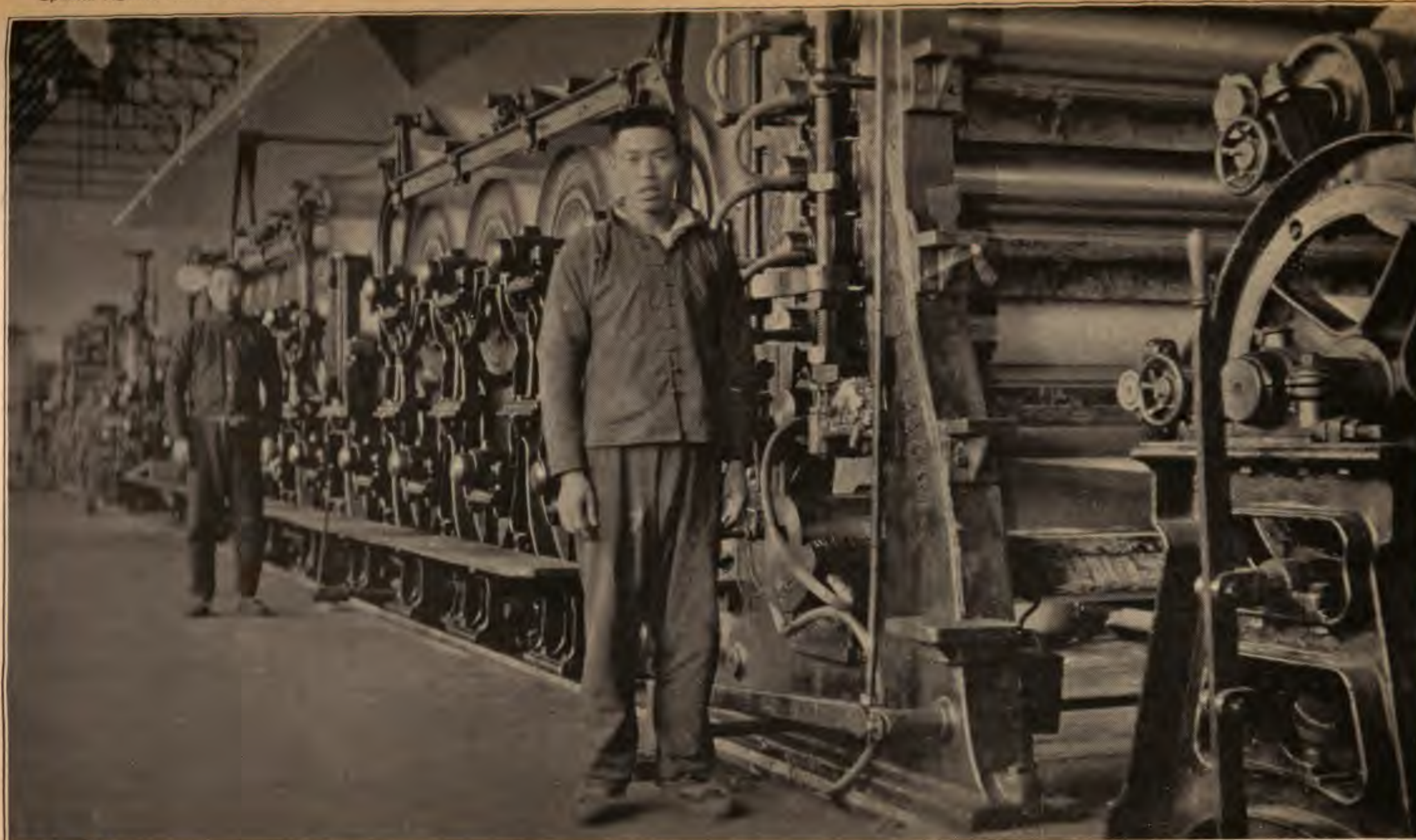


FIG. 32.—AMERICAN PAPER-MAKING MACHINE, CHINESE GOVERNMENT PAPER MILL, HANKOW.

FIG. 33.—AMERICAN RAG-WASHING MACHINERY, CHINESE GOVERNMENT PAPER MILL, HANKOW.

the Province of Fukien, to be peculiarly rich in a great variety of minerals; it has, however, a most inadequate railway equipment, for not only are the lines in operation less than a total of 700 miles, but there is very little additional line projected. Industrial development in South China will apparently be delayed until the railways and mines have been opened up and can supply the transportation, fuel, and raw materials needed, but when this is done it will be a wonderful blessing for the people.

POSITION OF CANTON.

Canton occupies a position in South China that may be compared with that of New Orleans in that part of the United States mentioned above, except that in China river traffic is relatively of far greater importance, for there are no highways leading out of the city and the limited railway facilities handle only a small amount of traffic. It was at Canton that Europeans first developed trade with China, and much of the history of China's foreign relations centers there. Among the early visitors the Portuguese established a foothold at Macao, but as this harbor is shallow, modern commerce passes it by and Macao does not seem to promise well for the future. Similarly, Canton Harbor is not suitable for most ocean-going vessels, and trade has established itself at Hongkong, which is one of the most important harbors in the world, the tonnage entered and cleared ranking far above any other port in Asia or any other port in the British Empire and being exceeded, in the whole world, only by New York and Hamburg. Because of this vast amount of shipping one is frequently led to believe that the trade of Hongkong is heavy, but this is a misapprehension, for the harbor forms an outer terminal for many transportation lines, and many vessels discharge very little cargo.

MACHINERY IMPORTS OF SOUTH CHINA.

The volume and nature of the net industrial-machinery imports through the 15 treaty ports of South China, as given by the returns of the Chinese Maritime Customs, are shown below:

Items.	1915	1916	1917	1918	1919	1920
Machine tools..haikwan taels..	12	1,206	1,482	3,695	568	10,705
Propelling machinery...do....	31,136	22,304	9,049	8,952	5,249	2,895
Textile machinery......do....	2,786	10,224	18,848	4,938	4,774	2,098
Brewing machinery.....do....	....	....	....	....	27,383	26,340
Other machinery........do....	322,787	148,559	206,192	261,800	629,101	1,846,235
Total for South China ....haikwan taels..	356,721	182,293	235,571	279,385	667,075	1,888,273
Exchange rate[1]...............	$0.62	$0.79	$1.03	$1.26	$1.39	$1.24
Total for South China in United States currency.................	$221,167	$144,011	$242,638	$352,025	$927,234	$2,341,459
Total for all China in United States currency............	$2,805,773	$4,933,230	$5,713,460	$9,616,249	$19,673,491	$27,517,821
South China's percentage of total for all China............	7.9	2.8	4.2	3.7	4.7	8.5

[1] Value of haikwan tael expressed in United States currency.

NOTE.—It will be observed that the totals in this table do not check with those on page 238, which are the gross imports and from which certain reexports (sometimes more than 10 per cent) might be subtracted. Also, the returns on this page and similar tables hereafter include a certain amount of duplication, as inter-port domestic shipments are included. The returns are published in such a way as to make it impossible to arrive at the net imports from the several countries into the different districts.

OUTLOOK FOR FUTURE.

Having had some previous experience of the East and having heard a good deal about the importance of this section, the writer was somewhat surprised to learn that it absorbed less than 5 per cent of the industrial machinery imported into China. Referring to future prospects in South China a recent writer says:

> The great demand, however, will be for electric light and mining machinery. The tin output from Yunnan has gone up enormously. Hongkong shows what has been happening, for nearly all of the tin that is sold in South China is analyzed at the local government laboratory. In 1916 the export of tin from Hongkong was worth about 1,000,000 gold dollars; in 1917 it was worth about 3,000,000 gold dollars; in the first nine months of 1918 the value of the tin exported from Hongkong was 13,000,000 gold dollars. But there are other metals in Yunnan, and once modern machinery is at work we may expect almost anything.[a]

Unquestionably this part of China will develop wonderfully, but past experience is shown by the above figures and the immediate future will probably compare with it.

EXISTING INDUSTRIES.

So far as could be learned, the industries now in South China are as shown in the lists below, but in this connection one should remember that it is exceedingly difficult to secure complete and accurate information in present-day China, and South China is probably more difficult than the other sections.

Foochow has a foreign population of 1,824, of whom 296 are American and about an equal number British. In this city there are six American firms and 18 British firms. In the neighborhood there are:

Foochow Electric Co., with two 1,000-kilowatt steam turbines. Some of the plant is British and some American.

Chinese Government Dockyard, with dock 340 feet long and three building slips, for vessels up to 5,000 tons.

Foochow Ice & Aerated Water Co.; British.

Foochow Ice Co.; Japanese.

Yung Kee; Chinese.

Ho Sheng Kee; Chinese.

These last four companies produce about 900 tons of artificial ice per year, most of which is used for cooling fish.

Standard Oil Co.

Asiatic Petroleum Co.

Both of these concerns have plants for making oil cans.

Five sawmills of fair capacity, possibly 100 to 500 logs per day each; machinery of American, British, and German origin, much of it of old pattern.

Fukien Telephone Co., with about 600 subscribers.

Kwok Kwang Match Factory.

There are also an important number of native industries producing furniture, glassware, paper, rope, salt, and tea in primitive ways, employing no machinery of consequence. Also, there is some mining

[a] "The British in China," by C. A. Middleton Smith, p. 228. The tin exports from Hongkong for the entire year 1918 exceeded £4,570,000 and in 1919 fell to £1,827,838. In 1920 the value was £3,921,791, while in 1921 it was £1,387,800. It should be noted that probably less than 40 per cent of this tin is from Yunnan. When statistics are used as above they exaggerate the true prospects of the markets of China.

and rice cleaning which may use a little machinery, but this is of types that are too elementary to be known on the American market.

In the neighborhood of Amoy, where there are no American firms, the following concerns may be listed:

Amoy Tinning Co.
China Canning Co.
These are two Chinese corporations operating canning factories preserving foods for Chinese consumption. American machinery is used.
Amoy Shipbuilding Yard; dock, 370 feet long; a repair yard.
Amoy Electric Light & Power Co.; has two 100-kilowatt and one 300-kilowatt steam turbines, of American make.
John Pickards & Co. (Ltd.); operate an electric plant of 150-kilowatt capacity, suction-gas drive.
Changma Electric Light & Power Co.; operates an electric plant of 80-kilowatt capacity, gas-engine drive.
Chioh-be Electric Light Co.; operates a plant of 74-kilowatt capacity, gas-engine drive.
Chuanchow Electric Light Co.; plant of 751-kilowatt capacity, gas-engine drive.
Amoy Pharmacy; operates an ice plant of 3 tons capacity.
Amoy Ice Manufacturing Co.; plant of 4 tons capacity.
Standard Oil Co.
Asiatic Petroleum Co.
These last two firms have filling and can-making plants.
Changchow-Amoy Railway shops; plant to care for a railway 18 miles long.
Primitive industries somewhat similar to those in the Foochow district.

In the neighborhood of Canton the following concerns may be listed:

Chinese Government Dockyard.
Kwang Nam Dock Co., can build vessels up to 3,000 tons and make the engines and boilers; uses British equipment.
Hip Tung Wo Motor Engine Works.
Quam Wo On.
The above and several other shops produce semi-Diesel crude-oil engines and suction-gas engines and producers, which are used in large numbers in the small factories and on the river boats, which are very numerous.
Mien Yuan Paper Factory; 4 tons per day.
Kongmoon Paper Manufacturing Co.; 3 tons per day.
Hao Ming Match Factory.
Canton Ice Factory.
Canton waterworks.
Canton Government Mint.
Government Cement Plant; beehive-type kilns; 500 barrels per day; German machinery.
Yu Yick Brick Factory.
Canton Electric Light Co.; steam plant with two 2,500-kilowatt turbines, but designed for 35,000 kilowatts ultimate capacity; American design.
Twenty-nine small electric plants in the other cities of the territory—most of them very small.
Li Ming Mirror Factory.
Primitive industries similar to those mentioned above.
Railway workshops.

As estimating the possibilities, perhaps it should be added that there are a number of ventures that have been failures: At Foochow—An albumen plant; a brick plant using modern machinery. At Amoy—Sugar refining. At Yunnanfu—Flour mills. At Canton—A tannery.

While it can not be claimed that the above lists are complete, they are probably reasonably so, and it is believed that they do full justice to the present development.

Practically all the machinery imported into South China is shipped through Hongkong, and the merchants who cultivate this territory are nearly all established there.

Some of these merchants also have offices in Central and North China. Some firms are in Canton as well as Hongkong, while others are only in Canton. But generally speaking Hongkong is the machinery market for South China.

MACHINERY FROM HONGKONG.

The total value of the factory machinery imported into China from Hongkong and its relation to the entire machinery trade of the country is as follows:

Years.	Value in haikwan taels.	Exchange rate.	Value in United States dollars.	Percentage of total machinery imports of China.
1911	682,906	$0.65	443,890	10.3
1912	372,326	.74	275,521	7.9
1913	348,214	.73	254,196	4.9
1914	665,852	.67	446,126	8.2
1915	409,590	.62	253,946	9.2
1916	163,664	.79	129,275	2.6
1917	222,728	1.03	229,410	3.7
1918	400,295	1.26	504,372	5.1
1919	683,375	1.39	949,891	4.8
1920	1,558,503	1.24	1,932,544	6.9

It will be noted that some of these Hongkong shipments go to points north of South China, but in a general way these returns check up with the trade for South China. Also, on the average for a decade Hongkong has supplied only about 6 per cent of the industrial machinery absorbed in China, this percentage amounting to less than half a million dollars per year.

HONGKONG.

But on the other hand it must not be assumed that South China is the limit of the Hongkong market, for it supplies a much wider field, making shipments to Indo-China, Siam,[9] Federated Malay States, and Borneo, and less regularly to the Philippines, the Dutch East Indies, and British India. Furthermore, the colony of Hongkong itself seems to absorb a considerable volume of machinery.

As the authorities did not publish returns of this trade previous to 1918 it is not possible to determine its nature and volume in what were considered normal times. The following table presents the figures

[9] The writer did not personally investigate conditions in Siam or Indo-China.

that are available, from which it will be noted that the total is several times as much as is needed to meet the demands of South China:

Items.	1919 (exchange @ $4).		1920 (exchange @ $4).		1921 (exchange @ $4).	
	Pounds sterling.	Dollars.	Pounds sterling.	Dollars.	Pounds sterling.	Dollars.
Total machinery imports	580,427	2,321,708	717,523	2,870,092	1,120,691	4,482,764
Exports to China	127,209	508,836	134,360	537,440	230,127	920,508
Other exports to Asia	48,329	193,316	53,740	214,960	34,897	139,588
Other exports	460	1,840	16,671	66,684	7,433	29,732
Total exports	175,998	70,399	204,771	819,084	272,457	1,089,828
Remaining in the colony	404,429	1,617,716	512,752	2,051,008	848,234	3,392,936
	Per cent.		*Per cent.*		*Per cent.*	
Imports from United States	47		30.6		23.6	
Imports from United Kingdom	39		56.8		67.8	
Imports from other countries	14		12.6		8.6	

As regards the large amount of machinery remaining in the colony it is very difficult to determine how much is absorbed locally and how much is held in warehouse stocks of the local dealers for distribution later, but probably both items represent large amounts.

The industries in the colony of Hongkong are:

Green Island Cement Co.; two plants; capacity, 75,000 casks per month.

A. S. Watson & Co. (Ltd.); aerated water.

Royal Aerated Water Manufacturing Co.

Hongkong & Whampoa Dock Co. (Ltd.); operates eight building berths, three docks, and two slips; repairs all classes of ships and builds them up to 5,000 tons or larger.

Taikoo Dockyard & Engineering Co. (Ltd.); dock 787 feet long; shipway for 3,000-ton vessels, two shipways for 2,000-ton vessels; five building berths for vessels up to 10,000 tons.

W. S. Bailey & Co. (Ltd.); engineers and shipbuilders.

Kowloon Engineering Works; engineers and ship repairers.

China Light & Power Co. (Ltd.); capacity 1,500 kilowatts.

Hongkong Electric Co. (Ltd.); capacity 2,800 kilowatts.

A. Long & Co.; furniture factory.

Lane Crawford & Co.; furniture factory.

Wm. Powell (Ltd.); furniture factory.

Cheong Lee; furniture factory.

Hongkong & China Gas Co. (Ltd.); capacity 300,000,000 cubic feet.

Hongkong Ice Co. (Ltd.); ice capacity, 135 tons per day; cold storage, 150,000 cubic feet.

Six small leather tanneries.

Tai Shing Paper Manufacturing Co.; capacity 2,400 tons per year.

Kowloon-Canton Railway shops.

Hongkong Rope Manufacturing Co.; capacity 5,000,000 pounds per year.

Hongkong Saw Mills.

China Mining & Smelting Co.

Hongkong Soap & Soda Manufacturing Co.

Star Manufacturing Co. (Ltd.); soap.

China Sugar Refinery Co.; capacity 75,000 tons per annum.

Taikoo Sugar Refinery Co.

China & Japan Telephone & Electric Co. (Ltd.).

Nanyang Bros. Tobacco Co.; cigarette factory.

Hongkong Tramway Co. (Ltd.).

Peak Tramway Co. (Ltd.).

Hongkong Water Works.

Wei San Knitting Co. (Ltd.); capacity 50,000 dozen singlets per year.

The above lists exclude the electric plant and a few other industries in the Portuguese territory of Macao, but, in general, they will indicate the nature of the industries supplied through Hongkong. This development has been restricted by a number of causes, among which is the fuel problem. As a port Hongkong imports all its coal, the volume and sources of supply being shown in the following table:

Regions.	1919		1920		1921	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
North China	128,355	£464,776	208,587	£738,102	266,531	£552,362
Japan, Korea, and Formosa	658,572	2,351,611	645,348	2,442,532	672,106	1,461,848
Indo-China	120,806	258,144	161,390	350,347	228,755	285,302
Other	12,374	45,378	2,945	11,526	8,479	20,886
Total imports	920,107	3,119,909	1,018,270	3,540,507	1,175,871	2,320,398
Total exports	214,968	611,045	260,322	728,656	295,709	510,800
Consumed in the colony	705,139	2,508,864	757,948	2,811,851	880,162	1,809,598
Exported to South China	209,609	584,372	254,487	707,218	288,476	492,195

Possibly it is indicative of the difficulty of accomplishing things in China that Hongkong and even Canton find it necessary to import practically all of their coal, mostly from Japan, at high prices, while the Kwangtung coal field lies only perhaps a hundred miles away, is already reached by railway and, although reported to be a good prospective field, is estimated to produce only 50,000 tons per year. Even the Kowloon-Canton Railway is reported to use imported coal. At different times foreign syndicates of one nationality or another have succeeded in negotiating preliminary contracts looking to the exploitation of some or all of the coal measures of Kwangtung, but complications have arisen to prevent active mining. Under favorable conditions coal could be laid down in Canton or Hongkong for less than $5 a ton, while now it costs several times as much.

Because of this situation the electric plants at Canton and Macao have Diesel-engine drive. The former plant developed to a point where it had a capacity of nearly 3,000 kilowatts, using a great variety of engines from most of the leading countries, when it was decided to change to steam drive. This new plant is typically an American design and, excepting the boilers, has American-made machinery. From what could be seen in a hurried visit, it seems to be a very high-class installation. At first the plant will have two turbines of 2,500 kilowatts each; later extensions are to include two 5,000-kilowatt and two 10,000-kilowatt turbines. This is one of the few plants in Asia that have been properly designed from the start by competent American consulting engineers, and it shows clearly the resulting advantages.

At the end of this section will be found detailed customs returns showing the kinds of machinery imported at Hongkong, from which it is apparent that war conditions have strongly influenced the trade and it is difficult to estimate what the normal demand might be. It will be noted that there is a heavy demand for internal-combustion engines, and the record of American and British exports is also shown

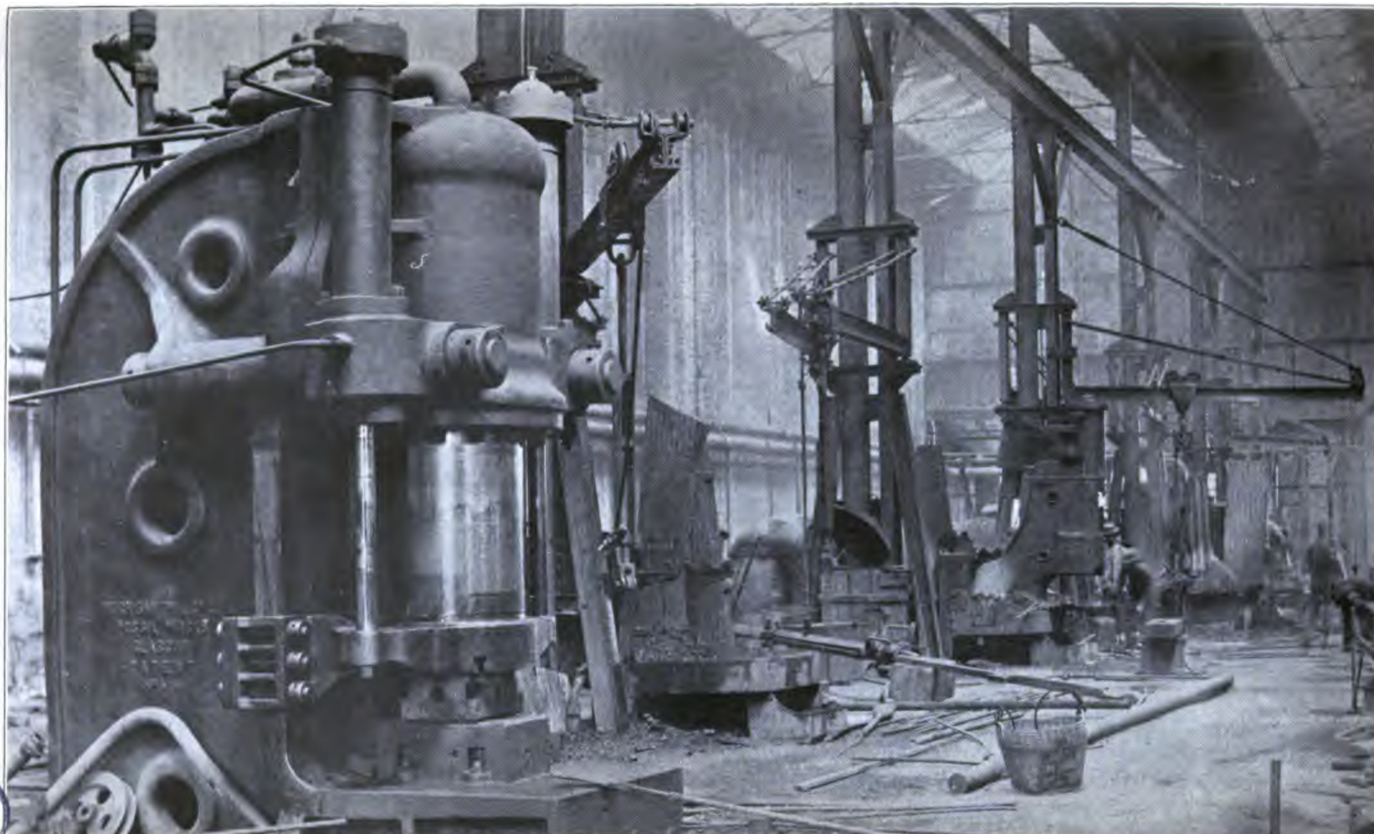


FIG. 34.—SCENE IN PLANT OF TAIKOO DOCKYARD & ENGINEERING CO., HONGKONG.

FIG. 35.—CANTON SAFETY VALVE.

FIG. 36.—AMERICAN AIR COMPRESSOR MOUNTED ON AN ENGLISH BOILER, AT WORK IN MADRAS, INDIA.

on other pages. In the Chinese shops at Canton, semi-Diesel engines are produced that are copied from a Swedish design, the largest shop building a total of about 2,000 horsepower annually in 20, 40, 60, and 80 horsepower sizes (also sometimes larger) which are offered at prices of about $90 to $100 per horsepower. These engines are noted more for cheapness than for quality, and they suffer a good many hot-bulb failures.

Hongkong has ample facilities for handling a large machinery business, even much larger than is shown by the accompanying returns. In all respects its shipping, cable, postal, and port facilities seem to be more than adequate. Strictly speaking, Hongkong is an island (area, 29 square miles), but the name has been extended to include two other small islands and a small district, Kowloon, on the mainland—the whole colony thus covering 390 square miles. The population of the colony is about 547,350, of whom 14,000 or 15,000 are Europeans (excluding the army and navy) and about 250 Americans. The name of the city is Victoria—an expression that is seldom used. In the city there are about a dozen merchant firms that are well equipped to sell machinery in this market. As stated, some of these firms are represented elsewhere in China and some are not. Most of these firms are British, but some are American and the market shows a very active interest in American machinery.

SIAM AND INDO-CHINA.

Siam has an area of 220,000 square miles (Ohio has 41,040 square miles) and a population of 8,150,000 (Ohio has 5,759,368). The length of the railways in Siam is 1,333 miles (Ohio 9,012 miles). The capital, Bangkok, is also the principal business center and was the port of entry for 93.7 per cent of the machinery imported into Siam in 1921. Practically all of the remainder entered from British Malaysia. The volume of the machinery imports into Bangkok have been:

[Conversions made at the rate of 1 tical=33⅓ cents.]

Articles.	1916–17	1917–18	1918–19	1919–20	1920–21
Electrical goods and apparatus	$284,998	$276,911	$375,104	$457,932	$360,006
Locomotives		8,944	7,703	141,194	459,096
Marine engines	70,931	33,696	51,607	80,506	103,035
Other prime movers	13,570	53,979	17,584	352,527	339,897
Rice-milling machinery	2,612	174	339	3,158	72,240
Textile machinery	4	5	188	485	1,408
Dredging machinery	(1)	(1)	153,054	60,204	4,842
Machine tools	21,154	31,022	54,062	43,570	51,889
Other machinery	314,882	99,834	121,444	143,562	345,578
Total	708,151	504,565	781,085	1,283,138	1,737,989

[1] Included in "Other machinery" prior to 1918–19.

Siam is noted as a producer of rice, teak, and tin, but it will be noted that machinery imported for rice milling seldom reaches an important total and sawmill equipment is not even given separate mention. During the years listed, 34 railway locomotives were imported; four were from the United States and there is reason to believe that the remainder were from the United Kingdom. In marine engines the participation was:

Countries.	1916-17	1917-18	1918-19	1919-20	1920-21
Total	221	159	76	111	72
United States	161	143	69	88	29
United Kingdom	38	10	6	23	36

In the "Other prime movers" the participation was:

Countries.	1916-17	1917-18	1918-19	1919-20	1920-21
Total	14	10	18	100	168
United States	....	2	3	54	41
United Kingdom	9	5	2	26	86

Presumably this classification and also the "Marine engines" include a great many internal-combustion units. In the machine tools the American participation has been 11, 35, 32, 56, and 3 per cent for the respective years, and the British participation 50, 43, 5, 38, and 92 per cent. These figures are not entirely satisfactory, because important shipments are credited to Hongkong, Singapore, Burma, etc., but even with these allowances their significance seems obvious.

The area of Indo-China is estimated to be 260,000 square miles, and the population is variously estimated to be between 10,000,000 and 17,000,000. The European population, mainly French, was 23,700, including the military, in 1914. The most important city is Saigon, capital of Cochin-China, with a population of about 100,000, near which is the native city of Cholon with a population, mainly Chinese, of 170,000. These two cities have a large commerce and are the center of a very important rice-producing district. Further north Hanoi (150,000) and Haiphong (25,000) also form a notable combination, with important commerce; coal is produced in quantity in this district. There is a very active road-building campaign in Indo-China, the total mileage exceeding 11,000, of which more than 3,100 miles have been paved for widths varying from 6½ to 23 feet. The railway mileage is 1,282, with plans for a great deal more. In 1915 Indo-China produced about 750,000 tons of anthracite coal, much of which was exported. In 1918 more than 90 per cent of the imports came from countries other than France and its colonies, and of these outside imports nearly 80 per cent were from Hongkong and Singapore.

The machinery imports into Indo-China in 1918 were as follows:

[Values in United States currency.]

Articles.	From France.	From United States.	From other countries.
Stationary and marine engines; steam pumps	$2,127	$55	$1,593
Traction engines	....	....	5,317
Locomotives, rail and road	2,794	3,240	10,728
Pumps, blowers, etc	2,404	276	5,061
Machine tools	4,264	340	18,447
Electrical machinery	9,039	1,636	2,745
Total	20,628	5,547	43,891

The returns of the Hongkong customs showing exports of industrial machinery to Siam and Indo-China are as follows:

Years.	Siam.	Indo-China.
1918	£4,643	£31,416
1919	1,163	13,916
1920	1,900	21,742

In Siam the trade per capita is greater than in Indo-China, but it is anticipated that the latter country will develop rapidly. Details of American machinery exports direct to Indo-China and Siam are shown on pages 280 and 281.

MANCHURIA.

GEOGRAPHY AND COMMUNICATIONS.

Just as the machinery markets of South China are separated and distinct from those of the central part of China, there is a similar independent section in the north, although the line of demarcation is not so clear and there is a considerable traffic back and forth, both by rail and by sea. Generally speaking, this territory coincides with the boundaries of Manchuria, which includes the three Provinces—Fengtien, Kirin, and Heilungkiang. But it is probably more accurate to include in this region all territory north and east of the Great Wall from the point where it touches the sea at Shanhaikwan; this delimitation would then take in a part of Chihli and would include any machinery absorbed in Mongolia.

Manchuria proper is the important part of this territory and has an area of about 263,700 square miles (a little larger than the 13 original American States), and the population is estimated at between 15,000,000 and 17,000,000. For all of this section the principal port is Dairen (also sometimes called Tairen or Dalny), which is about four days by sea from Shanghai. The journey can be made by rail in a somewhat shorter time. The corresponding journeys to Kobe, Japan, are somewhat shorter. Manchuria can also be entered by rail from Korea at Antung, from Vladivostok at Suifenho, from western Siberia at Manchouli, or from the south at Chinwangtao. All these places are treaty ports, Manchuria having 11 such ports altogether, but no very important amounts of machinery are imported except at Dairen, which possibly absorbs more factory machinery than any other port in China except Shanghai and consequently is very important, ranking ahead of Hongkong up to 1920.

Machinery shipments for Dairen are usually transshipped at Shanghai or at Japan ports. Probably more of this is done at Kobe than elsewhere, as the freight rates are understood to be a little more favorable.

MACHINERY IMPORTS OF MANCHURIA.

The value of the industrial machinery imported through the 11 treaty ports of Manchuria, as given by the Chinese Maritime Customs, is as follows:

Items.	1915	1916	1917	1918	1919	1920
Machine tools..haikwan taels..	15,099	18,683	138,194	233,260	207,182	201,985
Propelling machinery...do....	169,748	6,926	49,108	103,545	279,772	246,372
Textile machinery......do....	6,232	5,230	5,831	34,938	303,606	112,785
Brewing and distilling machinery......... haikwan taels..	18,865	446	85,376	16,187	1,078	10,499
Other machinery.......do....	669,019	987,414	1,415,661	2,361,108	2,892,304	1,759,985
Total for Manchuria.do...	878,963	1,018,699	1,694,170	2,749,038	3,683,942	2,331,626
Exchange rate[1].............	$0.62	$0.79	$1.03	$1.26	$1.39	$1.24
Total for Manchuria in United States currency.................	$544,957	$804,772	$1,744,995	$3,463,788	$5,120,679	$2,891,216
Total for all China in United States currency.............	$2,805,773	$4,933,230	$5,713,460	$9,616,249	$19,673,491	$27,517,821
Manchuria's percentage of total for all China...........	19.4	16.2	30.5	36.0	26.9	10.5

[1] Value of haikwan tael expressed in United States currency.

It will be noted that this portion of China has often absorbed more than a quarter of all of the machinery imported into the entire country, although including less than 5 per cent of the total population. The value (in United States currency) had been multiplied nearly ten times in five years up to 1919, but suffered a severe setback in 1920. Details as to the nature of these imports as shown by the export returns of Japan and the United States are given in the section beginning on page 277. The British returns combine the figures for exports to Manchuria with those for Japan, so that a separate statement for the United Kingdom is not available (see p. 332).

Reference has been made above to the comparative importance of the various cities as machinery markets. This situation is shown more fully in the table below, giving the value of machinery imports. Conditions are changing rapidly in this part of the world and it is not at all safe to prophesy, but it appears that Dairen absorbs as much machinery as Hongkong, Tientsin, or Hankow.

Ports.	1915	1917	1918	1919	1920
IN HAIKWAN TAELS.					
Shanghai	2,077,225	1,944,832	2,619,316	5,484,248	11,683,808
Dairen	493,853	1,542,205	2,537,824	2,941,746	1,921,146
Tientsin	388,591	332,076	640,663	1,870,175	2,472,421
Hankow	369,953	665,283	628,097	1,161,341	1,417,694
IN UNITED STATES CURRENCY.					
Shanghai	$1,286,880	$2,003,177	$3,300,338	$7,623,105	$14,432,122
Dairen	306,189	1,588,471	3,197,658	4,089,027	2,382,221
Tientsin	240,926	342,038	807,235	2,599,543	3,065,802
Hankow	229,371	685,241	791,402	1,614,264	1,757,941
Hongkong	....	....	3,133,927	2,321,708	2,870,092

NATIONALITY OF PURCHASERS.

The Manchurian demand represented by the above returns is partly Russian, partly Chinese, and very largely Japanese; in fact, in certain senses this territory may be considered as tributary to Siberia, to Shanghai and Tientsin, or to Tokyo, according to the nature of the business under consideration, and this is carried so far that certain

properly informed and well-organized American manufacturers maintain at least two distinct selling organizations in the same territory, one to solicit the Chinese trade and another to solicit Japanese business (with further subdivision in some cases for other sections of the population). At the moment the disturbed conditions in Siberia discourage hope of large business in selling machinery to the Russian community, and obviously it is impossible to determine what the future has in store, but there are interests that anticipate an early and most remarkable development in this section which will probably be reached through Harbin. The Chinese community also seems to be suffering from disturbed conditions, but it may be that they too have a promising future. The Japanese interests are the most active.

SOUTH MANCHURIA RAILWAY AND RELATED ENTERPRISES.

The most important Japanese enterprise is the South Manchuria Railway, which operates about 982 miles of standard-gauge railway, of which 238 miles is double-tracked. This company has also taken over the administration of the Korean Railways, involving nearly 1,000 miles of additional railway, and the equipment for these lines is very largely of American manufacture. It is true that in recent years some equipment has been made in the railway shops at Ryusan, Shakako, etc., but, in turn, the machinery and materials for these shops has to a large extent been purchased in the United States. The China Yearbook for 1919 says:

> Besides the railway the company manages many other important enterprises in Manchuria. It maintains regular steamship communication between Dairen and Shanghai in connection with the trans-Siberian mail service, manages Dairen Harbor, operates the Fushun collieries, supplies Dairen and several other towns with gas and electricity, has established hotels at its principal railway centers, manages and controls territory in the railway area (including the laying out of new towns and the development of the agricultural, industrial, and commercial resources), and directs many other less important enterprises.

The company's capital expenses up to March 31, 1916, were:

Railway	$36, 984, 817
Steamships, etc	2, 517, 281
Tramway and electrical equipment	2, 505, 321
Mines	8, 719, 638
Harbors and docks	6, 910, 745
Gas plants	712, 919
Shops	3, 198, 363
Hotels	1, 013, 474
Land	5, 405, 347
Land improvements	2, 260, 793
Sundry buildings	5, 845, 612
Total	76, 074, 310

The rate of development may be observed from the fact that three years earlier this total was $63,526,742, the progress being, therefore, at the rate of about $4,180,000 per year.

As the Imperial Japanese Government holds about 50 per cent of the shares of the company, it represents a combination of Japanese transportation, industry, finance, and Government for the development of the territory.

The electrical plants include those at Antung, Changchun, Fushun, Mukden, and Yentai, as well as some smaller plants; most of these

plants have capacity in excess of 500 kilowatts. There are also the tramways at Dairen and Fushun.

The mine interests include the Fushun mine, which is a remarkable property, employing about 18,000 men and extracting about 7,000 tons per day. The railway interests also have the mine at Anshanchan, where a considerable plant is being installed to be used in connection with neighboring iron ore, blast furnaces being put in for the production of pig iron and huge sums being invested in the undertaking. There are also some smaller projects.

The largest item in the matter of harbors and docks represents the railway company's very extensive facilities at Dairen—so much so as to make that harbor one of the best equipped in the Far East.

The principal shops are at Shakako, near Dairen (and the corresponding shop for the Korean section is at Ryuzan), while there are district shops near the docks in Dairen, at Antung, at Kungchuling, and at Liaoyang.

OTHER JAPANESE ENTERPRISES.

In addition to the railway there are a number of other Japanese enterprises in Manchuria, and the number is increasing rapidly. The following incomplete list may indicate roughly the nature of this development:

Chonslintze Brick Works, Dairen.
Electro-Chemical Industry Co., Fushun.
Cotton Weaving Mill, Liaoyang.
Kawasaki Dockyard Co., Dairen.
Ikebata Glass Works, Harbin.
Fujitani Sawmill, Antung.
Okura Sawmills (Ltd.), Antung.
Kuhara (Zinc) Refinery, Fushun.
Japanese Government cigarette factory, Newchwang.
Manchurian Explosives Co., Antung.
Onoda Cement Co., Chonshutzn.

There are a number of electric plants, vegetable-oil mills, furniture factories, printing offices, etc., for which it was not possible to secure particulars.

RUSSIAN INTERESTS.

The Russian interests are also very important, but most of them are north of Mukden. The most important single interest in this region is that of the Chinese Eastern Railway, which also manages the Southern Ussuri Railway—a total of about 1,100 miles of track built on a 5-foot gauge. It also has a small flotilla of towboats and barges on the rivers of this region. Because of war conditions, there is nothing to say about the equipment of this line. In addition, there are 8 vodka distilleries and 12 breweries in this section. All through northern Manchuria are small flour mills that are gradually being replaced by modern mills with a daily capacity of 40,000 to 50,000 bags. The China Yearbook for 1920 gives 19 mills at Harbin and 4 at Ninguta. A great deal of Manchurian wheat is milled in Japan.

There are also:

Vodiansky Glass Works, Harbin.
Kouznetzoff Ice Plant, Harbin.
Vodiansky Leather Factory, Harbin.
Ten sawmills.

Seven soap and candle factories.
Asiho Sugar Co., Harbin.
Two tobacco factories, Harbin.

CHINESE AND SINO-JAPANESE INDUSTRIES.

The Chinese industries in Manchuria include the Ai Kon Weaving Mill, at Newchwang, and a large number of vegetable-oil mills, about 20 of which are in Dairen and 18 in Antung, with capacities ranging from 500 to 2,500 tons of oil per annum, operating almost exclusively on soya beans.

There are a few Sino-Japanese enterprises in this territory, chiefly electric power plants which perhaps should be classed with the industries of the Japanese, as control usually is exercised by them. Altogether, in Manchuria there are 16 power plants (4 Chinese at Mukden, Changchun, Chinchow, and Kirin, totaling 1,660 kilowatts, and 12 Japanese), the total capacity of which is about 20,000 kilowatts; 7 of these, with a capacity of 4,360 kilowatts, are equipped with American machinery.

PLACES WHERE TRADE IS CULTIVATED.

In soliciting business in Manchuria it will be found necessary to cultivate the Chinese trade wherever it exists, while the Russian trade centers in Harbin and Vladivostok and the Japanese trade in Dairen, though it is ordinarily customary for Japanese buyers to return to Tokyo to take advantage of the facilities of that market when making important purchases.

From what has been suggested above it is obvious that this part of China north of the Great Wall is of very great importance. It is very prominent as producing wheat, vegetable-oil seeds, lumber, and minerals. Great efforts are being made to develop the industries of the district, especially the production of coal, iron, and other similar resources. As compared with the other parts of China, railway development is well advanced. Manchurian winters are severe, closing up certain of the harbors with ice even as far south as Tientsin and otherwise introducing conditions that discourage industry. Obviously, as railway development advances this situation will be improved. It seems probable that in the near future Manchurian industries will be developed very rapidly. The district is receiving a great deal of attention from certain Japanese interests, and it seems safe to conclude that the future of industry in Manchuria can be estimated from what we know of the development of industry in Japan in recent years—a growth that has been marvelously rapid. Also, in so far as the development of industry in Manchuria depends upon Japanese interests, just so far will this territory be an element of the Japanese market, more especially the Tokyo market.[10]

CENTRAL CHINA.

In previous paragraphs it has been possible to give separate consideration to (*a*) the markets of South China—that is, the area south of Santuao and the Fengling mountain barrier—and correspondingly

[10] Conditions in 1921 did not justify a personal visit to Siberia. In the table beginning on p. 282 will be found a statement indicating the value of American exports of machinery to that country during recent years. The war has had a very strong influence on this trade. The future is very obscure, but there are those who claim to see wonderful possibilities in Siberia.

to (*b*) Manchuria or, more accurately, Kwantung,[11] beyond Chinwangtao and the Great Wall.

EXTENT OF TERRITORY.

The great central part of China includes the valleys of the Yangtze and Yellow Rivers and extends far back to the mountains that form the western boundaries of China. It includes 11 of the most important Provinces of China and parts of four others and has 22 treaty ports, of which Shanghai, Tientsin, and Hankow are the most important. The area of this district approximates a million square miles, while the population has been estimated to be about 250,000,000 and may be 50,000,000 more or less than that great total. Large sections of this population are beyond the reach of occidental trade, as has been demonstrated many times, as for instance in connection with the operations for relief during the recent famine. The vastness of this territory may be estimated from the map at the beginning of this section. Its resources are tremendous and will have a very great influence on international trade when properly developed.

MACHINERY IMPORTS OF CENTRAL CHINA.

Generally speaking, the above district is the one that is known as the heart of China and is the one that is usually meant when one refers to China. The volume of the industrial-machinery imports into this section, as reported by the Chinese maritime customs, is shown in the table below, which covers the imports at the 22 treaty ports between Chinwangtao and Santuao, including Shanghai, Tientsin, and Hankow:

Items.	1915	1916	1917	1918	1919	1920
Machine tools..haikwan taels..	43,182	32,693	68,811	96,151	279,083	525,355
Propelling machinery...do....	509,139	571,442	280,825	472,560	1,161,562	1,880,343
Textile machinery......do....	1,340,170	1,913,469	1,199,064	1,653,662	3,416,423	6,824,166
Brewing machinery.....do....	6,557	10,923	884	3,165	2,193	17,105
Other machinery........do....	1,390,708	2,515,077	2,067,724	2,377,983	4,943,313	8,724,923
Total for Central China ....haikwan taels..	3,289,756	5,043,604	3,617,308	4,603,521	9,802,574	17,971,892
Exchange rate[1]...............	$0.62	$0.79	$1.03	$1.26	$1.39	$1.24
Total for Central China in United States currency................	$2,039,649	$3,984,447	$3,725,827	$5,800,436	$13,625,578	$22,285,146
Total for all China in United States currency............	$2,805,773	$4,933,230	$5,713,460	$9,616,249	$19,673,491	$27,517,821
Central China's percentage of total for all China...........	72.7	80.9	65.3	60.3	69.3	81.0

[1] Value of haikwan tael expressed in United States currency.

The returns of the Chinese customs do not classify these shipments in greater detail, but much additional information can be deduced

[11] The expression "Kwantung" is somewhat confusing. By derivation it comes from "Kwan" (wall) and "tung" (east) and refers to the district north and east of the Great Wall, including parts of China and Mongolia, as well as the three Provinces of Manchuria. As used by the Japanese in the expression "Kwantung Leased Territory" it refers to the Japanese leasehold of about 1,300 square miles at the tip of the Liaotung Peninsula, including Dairen and Port Arthur. Kwantung should not be confused with Kwangtung, the Province in South China, and the above difference in spelling can not be relied upon, as different writers use different forms. Usually the northern district is mentioned in connection with Japanese affairs, and the southern is most often referred to by British writers.

from the British, Japanese, and American returns, which are to be found in the section beginning on page 277. It is apparent that the machinery business for this section represents from 60 to 80 per cent of the business for all China, and has increased from $2,000,000 to $22,000,000 in six years. In view of the large portion of the machinery imports of China that go into this section, figure 29, published on page 240, may be taken as applying especially to central China, and as that chart is plotted on a percentage basis it should also be remembered that the value of this business is expanding very rapidly. It is interesting to compare this with the chart published in the section of this report dealing with Japan, which shows the growth of the exports of American machinery to these countries since 1910 (p. 286).

It will be noted from the table on page 258 that about two-thirds of the machinery imports shown in the above table enter at Shanghai; but in fact this is an inadequate measure of the importance of Shanghai as a market, because the orders for a great deal of the equipment imported at Tientsin, Hankow, and other cities are placed with the dealers and importers at Shanghai. Most of the firms that have offices in Tientsin, Peking, Hankow, etc., have their head China office in Shanghai. To this extent also the data in the table on page 6 of the introductory section of this report are deceptive.

SHANGHAI.

Shanghai originally was a walled Chinese city with narrow streets and the usual insanitary conditions. It was opened to foreign trade in 1843, and foreign concessions were established outside of the old city; these include the international settlement and the French settlement. It is 850 miles from Hongkong and is located on one of the tributaries of the Yangtze River well up from the sea. It has grown to be a remarkably fine city, including, in the whole district, about 1,500,000 inhabitants, of whom about 700,000 are in the international settlement and 170,000 are in the French settlement. Altogether, the 1919 census showed that there were 26,869 foreigners in the two settlements, the principal nationalities being as follows:

Japanese and Koreans	10,521	French	846
British	6,385	Germans	289
Americans	2,813	Danes	248
Russians	1,476	Italians	226
Portuguese	1,382		

In all, 35 nationalities are represented. The most important, numerically, are the elements from India and Indo-China, which include the municipal police.

In many respects Shanghai is the most attractive city in Asia.

HANKOW AND TIENTSIN.

Hankow and Tientsin are to a certain extent subsidiary to Shanghai. The former is about 600 miles up the Yangtze River and occupies a position with regard to Shanghai that corresponds roughly to that which St. Louis would have with regard to New Orleans if our Mississippi Valley were poorly equipped with railways and depended upon river transportation. Practically all of the machinery sales offices in Hankow are branches of Shanghai firms. The foreign population of Hankow is not large.

Tientsin is the port for Peking and adjacent Provinces, but as it has only about 13 feet of water over the bar at the harbor entrance, and as the harbor is closed by ice in winter, the business of the port suffers certain handicaps. The firms handling machinery at Tientsin are usually branches of Shanghai companies. The competent engineering staff of most of these companies usually lives in Shanghai and visits these other districts when necessary. Peking has never been formally opened for foreign trade, and technically merchant firms are not recognized as being in business there. It is true that there are a few modest establishments in the city, but these also are usually branches of Shanghai companies. In this sense it can be said that Shanghai is the machinery market for the vast area and population of this entire district, and the volume of its business is the total for the district, including that credited to the other treaty ports.

DEALERS AND INDUSTRIES.

In Shanghai there are a sufficient number of machinery dealers to care properly for the existing or prospective business. Many of these represent the various European nationalities, but there are also a number of important American firms that have long been established there and are adequately equipped for the business.

The industries of central China are of great variety and are scattered widely over extensive areas. Shanghai itself has a very considerable industrial development, having many cotton mills, shipyards, sawmills, cigarette factories, and a large electric power station. Hankow is sometimes called "the Chicago of China," for it is favorably located on the transportation routes of the interior country, or, again, it is called "the Pittsburgh of China," for it seems destined to develop an important iron and steel industry. Other areas show promise of industrial development, but the circumstances make it seem desirable to report specially upon certain particular classes of machinery.

TEXTILE MACHINERY.

The classification "textile machinery" includes a great variety of equipment. It is not such a long time since modern textile machinery was first introduced into Asia, and there is still a considerable demand for the types of equipment that are operated by hand. Although Japan exports a great deal of "textile machinery" to China it is not ordinarily of a type that could be used in a modern mill and does not compete with European or American equipment.

There is a considerable trade in knitting machinery of the types used in the production of hosiery, singlets, etc. This and certain other lines are very special and will not be given further space here.

Not many decades ago the teeming millions of China were clothed, if in cotton, in homespun and home-woven clothes which were often coarse and poor in quality largely because the native cotton from which they were made has very short staple. But it has been demonstrated that factory-spun yarn is attractive in the market, and this is now available there from many countries. The bulk of the demand is for the coarsest yarns, and price is emphasized very much. European and American mills can usually offer rather fine yarns from long-staple cotton, but the price is relatively high. India has offered

yarn from its growth of cotton. Japan seems to have been able to accomplish a great deal by offering an intermediate quality at an intermediate price, for the Japanese mills import cotton from America as well as India and carefully cater to the tastes of the Chinese. Of course, the same general situation applies to the cloths made from these yarns, and a very interesting situation has developed in China, as is shown by the following tables of cotton imports into China, which are copied from "America's Aims and Asia's Aspirations," by Patrick Gallagher:

COTTON YARN.

[000 omitted; picul=133⅓ pounds.]

Sources.	1902			1913			1917		
	Piculs.	Taels.	Percentage, by value.	Piculs.	Taels.	Percentage, by value.	Piculs.	Taels.	Percentage, by value.
Hongkong	991	21,554	39.3	689	18,478	25.8	512	18,243	28.9
India	908	19,943	36.3	657	18,437	25.8	553	16,150	25.6
Japan	517	11,962	21.8	1,273	32,128	45.0	1,014	27,807	44.1
Great Britain	25	823	1.5	5	199	.3	....	....	....
All others	34	602	1.1	76	2,227	3.1	25	855	1.4
Total	2,475	54,884	100.0	2,700	71,469	100.0	2,104	63,055	100.0

NOTE.—In 1919 India supplied 74 per cent and Japan 22 per cent of the cotton yarn imported into Hongkong, suggesting that Japan and India divide the China market about equally.

GRAY SHEETING.

[000 omitted.]

Sources.	1902			1913			1917		
	Pieces.	Taels.	Percentage, by value.	Pieces.	Taels.	Percentage, by value.	Pieces.	Taels.	Percentage, by value.
Hongkong	18	57	0.3	....	....	....	$\frac{4}{10}$	1	0.01
India	5	19	.1	....	....	....	1	4	.04
Japan	172	497	2.8	3,356	9,331	57.6	2,610	9,487	92.20
Great Britain	862	2,897	16.4	128	532	3.3	68	303	3.00
United States	3,833	12,197	69.0	1,559	5,722	35.3	65	249	2.40
All others	657	2,002	11.4	176	623	3.8	67	246	2.35
Total	5,547	17,669	100.0	5,219	16,208	100.0	2,811$\frac{4}{10}$	10,290	100.00

DRILLS.

[000 omitted.

Sources.	1902			1913			1917		
	Pieces.	Taels.	Percentage, by value.	Pieces.	Taels.	Percentage, by value.	Pieces.	Taels.	Percentage, by value.
Hongkong	41	153	2.30	41	204	2.3	21	114	2.0
India	3	8	.01	6	31	.4	1	6	.1
Japan	43	177	2.60	1,667	6,261	70.6	1,438	5,499	97.0
Great Britain	204	696	10.30	45	183	2.0	6	36	.6
United States	1,506	5,147	76.20	507	2,033	23.0	2	9	.1
All others	173	574	8.59	34	152	1.7	4	14	.2
Total	1,970	6,755	100.00	2,300	8,864	100.0	1,472	5,678	100.0

ALL PIECE GOODS.

[000 omitted.]

Sources.	1902 Taels.	1902 Percentage.	1913 Taels.	1913 Percentage.	1917 Taels.	1917 Percentage.
Hongkong	6,112	8.3	11,363	9.0	10,852	10.0
India	129	.2	460	4.0	277	2.0
Japan	2,057	2.8	22,592	19.0	53,505	53.0
Great Britain	41,456	56.0	59,592	52.0	·31,384	31.0
United States	20,111	27.2	8,933	7.0	430	.4
All others	4,098	5.5	11,454	9.0	3,676	3.6
Total	73,963	100.0	114,394	100.0	100,124	100.0

The above figures demonstrate that European and American cotton goods do not appeal to the Chinese market when the Indian and Japanese qualities are available at considerably lower prices. In the section of this report covering India this textile situation is discussed at some length. When it is remembered that even India imports yarns and cloths from Japan in important volumes, it is scarcely to be expected that Indian manufacturers would be disposed to expend much effort in China, but, for the reasons given, this seems to indicate that India is still short of mill capacity rather than that Japan is peculiarly well fitted to conduct such business. In fact, every economic advantage seems to be with India.

The mills in India, China, and Japan have been paying most handsome dividends, and in all of these countries the desire to expand spinning and weaving capacity has been very great. Very large numbers of spindles have been ordered from the machinery manufacturers of Europe and America, and the period required to make delivery has been progressively extended until in 1920-21 machinery manufacturers asked more than two years after order before delivery. Up to 1916 American manufacturers of textile machinery had not made much effort to secure orders in China, but the subsequent experience is startling evidence of the possibilities of foreign trade. The following tables, showing imports of textile machinery into China, apply to the entire country and illustrate what has happened since 1911:

Years.	United States and Canada.	United Kingdom.	Japan.	All other countries.	Total.
	Haikwan taels.	*Haikwan taels.*	*Haikwan taels.*	*Haikwan taels.*	*Haikwan taels.*
1911	7,161	241,234	60,159	23,028	331,582
1912	9,885	307,283	50,229	91,219	458,616
1913	2,615	572,150	112,500	52,459	839,724
1914	2,530	1,540,100	187,661	308,169	2,038,460
1915	15,446	1,076,229	253,490	74,346	1,419,511
1916	115,431	1,257,961	531,437	29,312	1,934,141
1917	218,928	669,649	300,607	24,616	1,235,800
1918	379,867	669,402	642,948	22,777	1,714,994
1919	1,944,350	813,254	897,760	112,042	3,767,406
1920	3,897,204	1,925,696	1,071,201	33,627	6,927,728

NOTE.—Shipments credited to Canada may reasonably be supposed to have come from the United States, as it is probable that this machinery was originally manufactured in New England and shipped via Vancouver.

It therefore seems clear that American textile machinery has attained a position of preeminence in the China markets, as the superiority of American equipment and plant designs is reported to be fully recognized there. This fact encourages the hope that other Asiatic countries will come to a like conclusion in due course. Converted to a percentage basis, the data in the above table are plotted in figure 30. American manufacturers have sold more than $25,000,000 worth of textile machinery in China since 1916 and are certainly to be congratulated upon their showing in the following diagram.

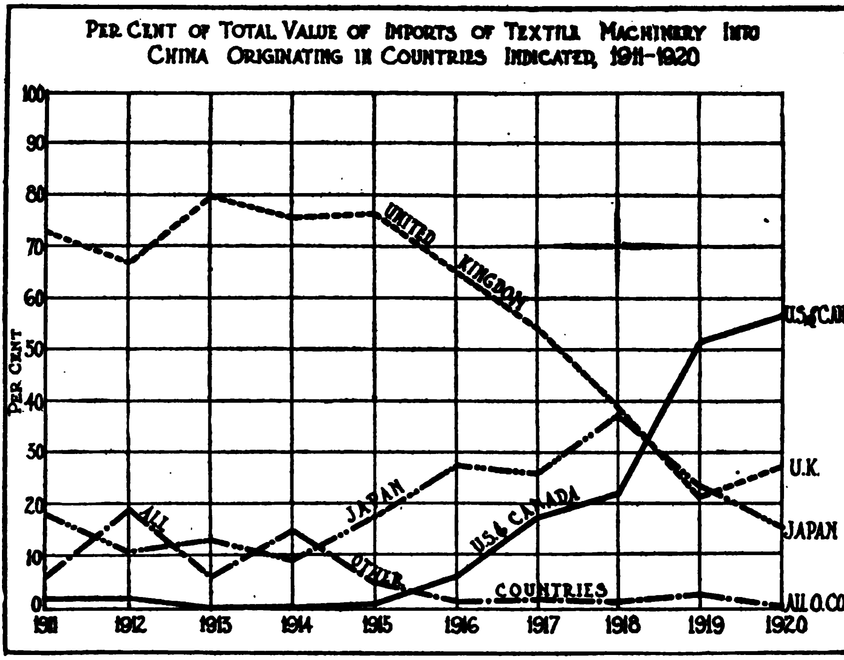


FIG. 37.

Under the circumstances described above, the competition in the China yarn market has not reached such a point as to force down prices to close margins, but one speculates with interest upon the ultimate result. It is not yet possible to determine which country will be found best able to supply this trade. The cost of machinery and plant seem to be about equal in Japan, China, and India, except for the Japanese import tariff. If labor is cheap in Japan, it seems to be cheaper in China and of still lower cost in India. All these countries can import American cotton where needed at substantially equal costs. The Indian mills have raw cotton at hand, but it is expensive to deliver the yarn to China. The Japanese mills find it necessary to import all cotton and deliver the yarn similarly. Many Indian mills use water power. Most Japanese and Chinese mills use steam. The Chinese mills seem to have advantages with regard to transportation costs, particularly when they can use Chinese cotton. The subject becomes exceedingly complicated, but it

seems significant that Japanese capitalists are now erecting mills in China. This would seem to indicate that the spinning industry in China has a most promising future.

From what could be learned (in the absence of Government industrial statistics and with no mill owners' organization) there are in China 68 Chinese-owned mills, having about 1,000,000 spindles in operation, and about 900,000 more in course of erection or under order; there are also 29 Japanese-owned mills, with about 800,000 spindles, and 5 British mills, with possibly 250,000 spindles—or a grand total of nearly 3,000,000 spindles in 102 mills when spindles now ordered are put into operation. Correspondingly, there are about 3,200 looms in the country and under order.[12] It seems obvious that this is an industry of first rank, and, regardless of what may have been said about a lack of progressiveness in China, will promptly develop to considerable magnitude. Similarly, it will stimulate the development of other industries.

The great importance of the textile-machinery business in China and the absence of American participation in that trade up to about 1916 explains in part why the United States has not supplied a larger proportion of the industrial machinery absorbed in that market. But it is now understood that there are more than 600,000 American spindles installed or under order for China, and the above condition is believed to be definitely removed.

Out of the 102 cotton mills in China, 48 are in or near Shanghai, 8 are in Tientsin, 4 are in Tsingtau, and several mills are being erected near Hankow.

MACHINE TOOLS.

The United States has long been noted for the excellence of its machine tools, and even before the war very important shipments of these tools were sent to Europe year after year. But in Siam, China, and certain other countries the railway and other concessions were in the hands of Europeans, as were also the dockyards, tramways, and water and other power plants. Even when some of these enterprises were nominally under the control of Chinese individuals or interests, foreign influences prevailed. The situation is illustrated by the following clauses taken from the agreement under which the German-controlled Shantung Railway was built: "German material shall be used, as far as possible, in the construction of the railways." "The railway is to be equipped in due time with rolling stock according to the requirements of traffic. The material shall be, as far as possible, of German origin."[13]

[12] It will be observed that these figures differ somewhat from the number of spindles credited to China in the usual publications and in the section of this report referring to India (because the latter data were from the ordinary formal sources). But the writer believes that the figures in the above paragraph are more nearly correct and that therefore China will soon have as many spindles as Japan and that India will have about as many as the other two countries taken together. In Japan at the end of 1918 there were 3,335,084 spindles, in 177 mills, and also 42,400 looms, and in that year about 57 per cent of the cotton consumed was from India, 29 per cent from America, 8 per cent from China, 3 per cent from Chosen (Korea), and small amounts from Egypt, Indo-China, and elsewhere. The writer was not able to learn how many spindles were on order, but the number was apparently very large. In India at the end of August, 1918, there were 6,653,871 spindles, in 262 mills, of which 4 were in course of erection; also, there were 116,454 looms. The United States has nearly 35,000,000 spindles and Great Britain more than 59,000,000.

[13] "Foreign Financial Control in China," by Overlach, p. 143.

For reasons of this kind American machine tools and other equipment have not been received on their merits as to price and quality in a very large number of cases.

With this situation in mind it is interesting to note the table below, compiled from the returns of the Chinese Maritime Customs and showing the imports of machine tools into China. Up to 1915, when the war had forced European countries to employ all their own machine tools, the United States occupied a very obscure position, supplying even a smaller value than Japan. From 1915 the United

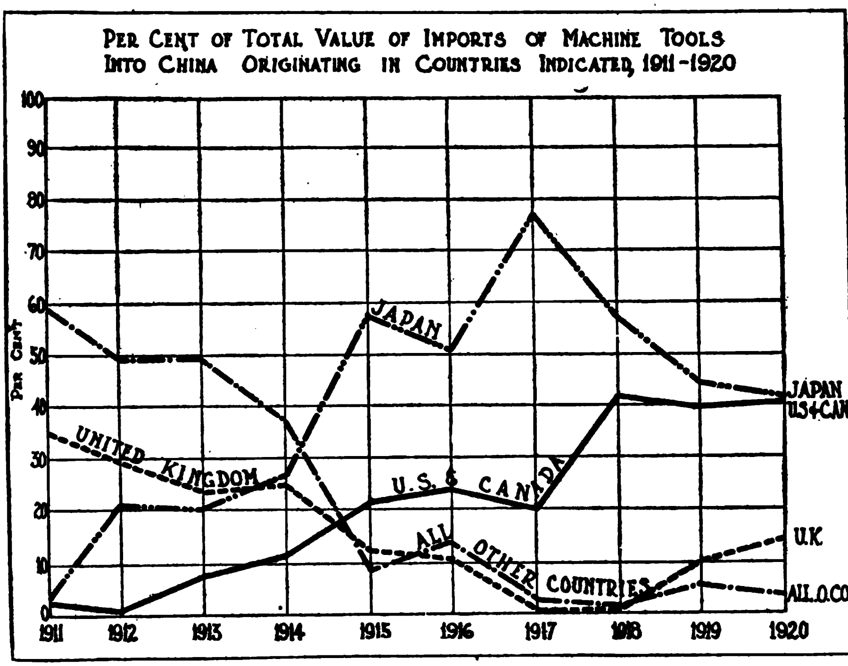


FIG. 38.

States position rose above that of all the European countries, and it is hoped that the 1921 returns will show the Americans in first place.

Years.	United States and Canada.	United Kingdom.	Japan.	All other countries.	Total.
	Haikwan taels.	*Haikwan taels.*	*Haikwan taels.*	*Haikwan taels.*	*Haikwan taels.*
1911	615	9,699	1,067	16,345	27,726
1912	133	5,726	4,112	9,658	19,629
1913	3,773	12,112	10,234	25,169	51,288
1914	11,001	24,040	25,771	36,100	96,912
1915	15,494	9,052	42,094	6,171	72,811
1916	23,403	10,772	49,740	13,863	97,778
1917	40,983	1,254	160,475	5,682	208,394
1918	145,571	2,598	198,954	1,985	349,108
1919	197,859	50,477	221,996	29,521	499,853
1920	305,780	111,038	316,636	27,619	761,073

Conditions in Europe—exchange rates and the like—have had a pronounced influence on this trade since 1918, although most readers

will probably be surprised to note that Germany has not accomplished more, in view of all that has been published regarding the influence of German manufacturers in the world's markets. Figure 31 shows graphically the returns in the above table as converted on a percentage basis and illustrates more clearly the influence of the war and its embargoes on the supply of machine tools in China. The tables on pages 249, 258, and 262 suggest the extent of the demand for machine tools in the different parts of China, and it seems safe to assume that a very substantial part (say 60 per cent) of the tools sent from Japan went to points in Manchuria.

ELECTRICAL MACHINERY.

The customs returns as published by the various countries are not always very clear in their description of electrical equipment. Machinery is often confused with other equipment and supplies. The returns from the United States separate motors and generators, while the returns from Japan seem to include transformers, telephones, and a great variety of accessory equipment with what might more strictly be called electrical machinery. The British returns also seem to include more classes of equipment than those of the United States. But, making all allowances, it appears that in China the demand for electrical machinery exceeds that for any other kind except textile machinery.[14]

Experience in China corresponds with that elsewhere. Electric light and power are popular. Plants are in demand everywhere, and plant capacity is rapidly outgrown. The Hongkong Electric Co. (Ltd.) sold in 1904 approximately 600,000 kilowatt hours, while in 1916 it exceeded 5,000,000 kilowatt hours, at which time it was refusing business. As has been stated, the plant at Canton was driven by a Diesel engine but, after installing to a capacity somewhat in excess of 2,000 kilowatts, is being converted to steam turbine drive, the initial installation being 5,000 kilowatts and the station being laid out for an ultimate capacity of 35,000 kilowatts. The plant at Shanghai first installed turbines of 1,000 kilowatts capacity; this has been increased successively as extensions became necessary, and it now has units of 18,000 kilowatts. The rapidity of the development at Shanghai is shown best by the following figures, which are taken from the annual report of the engineer in chief and manager for 1919:

Years.	Private lighting.	Public lighting.	Heating and cooking.	Power.	Traction.	Total.
	Kilowatt hours.	*Kilowatt hours.*	*Kilowatt hours.*	*Kilowatt hours.*	*Kilowatt hours.*	*Kilowatt hours.*
1914	12,325,247	1,055,272	395,675	15,230,639	3,626,838	32,633,671
1915	14,073,166	1,005,259	679,704	30,633,455	3,395,818	49,787,397
1916	14,285,888	1,058,772	899,585	42,042,853	3,873,699	62,160,797
1917	15,206,019	1,128,896	1,129,754	57,182,340	3,843,433	78,490,442
1918	14,444,261	1,141,973	899,852	66,024,895	3,764,678	86,275,659
1919	16,378,793	1,192,650	952,814	79,622,548	4,191,332	102,338,137

[14] For a full report on the market for electrical machinery, see Special Agents Series No. 172, entitled "Electrical Goods in China, Japan, and Vladivostok," published by the Bureau of Foreign and Domestic Commerce.

In 1916 the maximum demand was 19,167 kilowatts on a system with a normally rated capacity of 19,600 kilowatts. The load factor for the year was 38.2 per cent. In 1919 the maximum demand was 27,553 kilowatts, the plant capacity had been increased to 38,600 kilowatts, and the load factor was 42.39 per cent.

The plant at Peking is very greatly overloaded. All information obtainable shows a very rapid electrical development in every direction. The following import returns represent the growth of the demand for electrical machinery in China:

Countries of origin.	1914	1916	1918	1919	1920
Japan..........yen..	268,278	350,054	1,005,068	1,409,000	....
United Kingdom	£39,179	£36,567	£24,868	£41,922	£111,633
United States	$188,355	$230,288	$597,812	$3,047,815	$4,185,940

These figures clearly indicate that the electrical industry is very well established and is growing rapidly along modern lines. The China Yearbook for 1919 reports 87 electrical undertakings in China (62 in China proper and 25 in Manchuria), of which 80 are light and power services, 4 also include electric railway service, and 3 manufacture electrical equipment. Of these, 6 are conducted by the Chinese Government, 53 by Chinese firms, and 28 as foreign undertakings, of which 10 are Japanese. But this statement probably underestimates the total. Also, there are a good many small plants on ships and ashore, and a large number of farm-lighting sets are scattered very widely throughout all the Provinces. If one may judge by the experience in other countries, or such indications as can be seen in China itself, this market for electrical equipment will develop very rapidly to considerable importance.

VEGETABLE-OIL INDUSTRY.

China grows, among other oil-bearing products, cotton seed, peanuts, rapeseed, sesame, and soy beans. Large amounts of tea oil and wood oil are also produced. Apart from domestic consumption, China exports annually nearly 3,000,000 tons of seeds, oil, and cake. As has been pointed out in connection with the reports on the Philippine Islands and other countries, it should be profitable to extract these oils in Asia. Some modern mills are to be found in China, but a great deal of this extraction is still done in a very primitive way and in all probability the demand for suitable machinery will increase as better methods come to be recognized. The territory involved covers most of the Provinces of China, but soya beans are mostly found in Manchuria, peanuts in Shantung, and wood oil in the territory reached through Hankow. Unfortunately one gathers the impression that at present those engaged in extracting oil, both in the mills of modern type as well as in the primitive plants, have not adequate knowledge regarding the amount of oil left in the cake. It appears that manufacturers of this class of equipment should conduct an advertising campaign in China and also assist their customers to operate on more scientific lines.

FLOUR MILLS.

Wheat is the staple food in North China, much as rice is in South China, the dividing line being possibly near the Yangtze River, but even in South China wheat is grown as a crop secondary to rice. The total production of wheat has been estimated to approximate 26,000,000 tons per year. Manchuria is the greatest producer among the Provinces.

Flour mills have been established in different parts of China. As has been stated, there are 23 mills in Manchuria. Also, there are mills at Shanghai, Hankow, and other points in the Yangtze Valley and also at various places between these extremes. The China Yearbook for 1919 lists a total of 42 mills. The indications are that there will be a considerable increase in the number of flour mills before very long. So far as could be learned the best mills are equipped with American machinery, and it is believed that trade in this line will increase satisfactorily as time goes on.

GENERAL INDUSTRIAL SITUATION.

In order that a nation may be independent of the industries of other countries a very great amount of coordination is necessary. Without sources of supply for sulphuric acid, etc., practically nothing can be done in the way of chemical production, of which, of course, there is an endless variety. Without steel and iron nothing in the way of such manufactures can be attempted. These and other so-called "key" industries must be successfully established before it is possible to develop the general industries of the country. So far as could be learned, the chemical industry in China is represented exclusively by one plant for making sulphuric acid in Shanghai, unless we also include the plants in Manchuria which are under Japanese control and seem more closely related to the industrial system of Japan than to that of China. These include two sulphuric acid factories, two sulphate of ammonia plants, one calcium carbide plant, one lactic acid plant, one dyestuff plant, and one glue factory. Correspondingly, a certain amount of iron and steel is produced, but it does not meet the needs of the country and there is reason to believe that the qualities of the pig iron produced are not entirely satisfactory. From time to time one hears statements that stimulate the imagination: "The price of lump coal varies at different mines from 13 to 40 cents per ton." "Cast and wrought iron works out at $2.25 a ton." "It is extracted in a rude manner, but the product is equal to any iron in the world, while its price is only about 2 cents a pound. The working and transportation of coal and iron employ myriads of people, though they are miserably paid." These and other remarks apply to the Province of Shansi, and it is added: "Nothing but the want of roads and civilized means of intercommunication prevents the development of the mineral resources of Shansi."[15] As these products are so inaccessible they are beyond the reach of occidental trade and can not be delivered in Shanghai at a competitive price. The population of Shansi, estimated at 10,000,000, is similarly beyond the reach of ocean com-

[15] "The British in China," by C. A. Middleton Smith, p. 179; also, "The Middle Kingdom," by S. Wells Williams, vol. 1, p. 96.

merce. The commercial production of iron or steel in China seems to be confined to about five plants, and reports indicate that these furnaces do not produce commercial iron or steel at a competitive price. "The cost of manufacturing pig iron in China is approximately $50 gold per ton as compared with $27 in Pittsburgh. The coke alone needed to make 1 ton of pig iron near Hankow costs $33 Mex."[16]

The problems raised in providing China with a modern industrial organization are very involved, as will be clear from a study of the corresponding problems in India; in addition, there is the difference that in China there seems to be no force at work to coordinate the various activities, and the experience of Japan suggests that such control is very helpful. China often overstimulates one's imagination. The commercial and industrial possibilities of the country seem boundless. Probably they are really wonderful, but when it is remembered that a considerable percentage of the business enterprises in the United States fail from one cause or another, in spite of the fact that political conditions are stable and quantities of reliable business information are available to all, it appears that the industrialization of China will be a slow and painful process.

China is a land of wonderful potentialities. Endless opportunities seem to await the investor and business man, but Chinese and foreigners alike find the present situation most disappointing. Certain obstacles impede progress. In Manchuria the Japanese seem to have succeeded in overcoming many of these difficulties, but even in Manchuria this success is not very pronounced and until relief is secured the industrial development of the country and the progress of the people of China will be handicapped.

But in spite of all these circumstances it has been shown that Shanghai absorbed about $22,000,000 worth of machinery in 1920, and there is reason to believe that about 54 per cent of this was from the United States; so it is one of the most important markets for American machinery in the entire world, and it will be most unwise for the exporting manufacturer to neglect it. Chinese industry needs intelligent and honest promoters. The Chinese market needs aggressive, persistent, businesslike salesmanship.

FUEL.

It is not possible to furnish even approximate information regarding the fuel situation in so vast a country as China that will be of serious value in connection with the selection of suitable fuel-saving equipment for that market. Generally speaking, Manchuria has plenty of coal. The Fushun mines produce about 7,000 tons per day and other mines are also in operation. This coal is of rather poor quality, as explained more fully below. As has been shown, South China has no developed mines of importance, though there is reason to believe that there is an abundance of coal under ground. Fuel for Hongkong and Canton is imported largely from Japan but also from the other sources of supply mentioned on page 254. In the United States anthracite coal is found in eastern Pennsylvania and the coal becomes increasingly soft as one goes

[16] Commerce Reports, Sept. 16, 1920, p. 1272.

southwest. In Asia this seems to be reversed. The anthracite seems to be near Haiphong and the coal seems to become increasingly soft as one recedes from that place, either toward the north, with the poorer grades of coal appearing in Manchuria and Japan, or toward the west across India, coal in Baluchistan being inferior to that found in Bengal. It would seem probable that very good coal would be available in South China if that country were ever opened up. It also seems probable that it could be delivered in Hongkong at attractive prices if the mines could be freed from some of the present restrictions.

Central China receives some coal from Japan, some from Manchuria, and some from mines in China proper, as, for instance, the Kailan mines. In all, China appears to mine and consume about 23,000,000 tons of coal per annum. The imports of about 1,500,000 tons per annum are about offset by an equal volume of exports. South China imports; North China exports. About half of the coal consumed in China is used for domestic purposes. The amount consumed in industries, railways, and steamships is about 10,000,000 tons, which provides something of a measure of the industrial development of the country. The locomotives of the Chinese Government Railways (65 per cent of the 6,813 miles in China) consumed 674,120 tons in 1919. It therefore seems safe to assume that the railways consume about 1,000,000 tons per annum. The cost of coal per ton as reported by the different Government railways provides a rough measure of the relative importance of fuel economy in the different parts of China. The following table represents the experience of 1919 and gives the name of the railroad, the cost per ton of its fuel, and its location; the values are expressed in Chinese dollars, a silver unit that fluctuates a great deal when compared with American gold but is ordinarily worth about 50 cents:

Name of road.	Location.	Average coal cost per ton.
Kirin-Changchun	Northern Manchuria	$6.89
Ssu-Tsen	Central Manchuria	5.47
Peking-Mukden	North from Peking	5.48
Peking-Suiyuan	West from Peking	7.03
Tientsin-Pukow	Tientsin to Shanghai	6.82
Chena-Tai	East from Taiyuan	4.80
Taokow-Chinghua	West from Taokow	5.80
Kaifeng-Hanan	West from Kaifeng	8.66
Peking-Hankow	South from Peking; north from Hankow	6.36
Hupeh-Hunan	South from Hankow	4.13
Chuchow-Pinghsiang	In coal field south of Hankow	7.92
Shanghai-Nanking	West from Shanghai	18.10
Shanghai-Hangchow-Ningpo	South from Shanghai	19.61
Changchow-Amoy	Northwest from Amoy	19.63
Canton-Kowloon	Canton to the sea	20.61

It is very difficult to convey a satisfactory idea of the quality of the fuels used in China, as there is much variation. Generally speaking, Manchurian and Japanese coals are low-grade bituminous of a friable character, usually containing very little lump coal and much dust. They are rather high in volatile matter and will run from 12 to 24 per cent ash. The following prices (in Shanghai taels) were the quotations in Shanghai for Japanese, Chinese, and Manchurian coals for a given date in December, 1920:

Japan coal:
Miike lump; contracted for.
Miike small; contracted for.
Miike dust; contracted for.

	Taels per ton ex wharf.
Kishima lump	17.50
Shakano lump	15.00
Arate lump	14.00
Shimoyamada Kirigomi	13.00
Shin Shakano Kirigomi	13.00
Yoshinotami No. 1 lump	14.00
Yoshinotami No. 2 lump	12.00
Ochi lump	14.50
Kaiping coal:	
No. 2 lump	13.50
Washed nut	13.50
Washed slack	10.50
No. 1 slack	9.00
No. 2 slack	8.50
Fushun coal:	
Dust	11.00

Kirigomi; contracted for.
Lump; no stock.

Arrivals of coal during the fortnight were 69,822 tons. The above prices, as stated, are in Shanghai taels and fluctuate a good deal.

CEMENT PLANTS.

China has four cement plants, and there is one more in Hongkong. Altogether these plants have a capacity of about 2,000,000 barrels of cement per year. The demand is greater than the supply, and from 100,000 to 200,000 barrels of cement are imported from Japan and Indo-China. Good cement can be obtained when desired.

TRADE-MARKS AND PATENTS.

Inasmuch as the Chinese buyer closely associates the quality of the goods he purchases with the trade-mark or "chop" by which they are designated and relies on this absolutely in making subsequent purchases in case satisfaction was originally secured, it is obvious that the value of a trade-mark in Chinese trade is of primary importance. However, the customary legal provisions for securing trade-mark ownership found in most Western countries do not exist in China. The main obstacle that has impeded the establishment of definite laws has been the disagreement as to whether protection should be accorded the first user or the first registrant. A draft of a proposed trade-mark law likely to prove satisfactory to all parties is now (October, 1922) under consideration. Pending the promulgation of a law generally acceptable, an indirect form of protection may be obtained along the lines indicated below.

A provisional registration of a trade-mark or "chop" may be secured by applying through the American consulates general or local attorneys to the Chinese Maritime Customs authorities at either Shanghai or Tientsin, which function as branch offices in the absence of a central registration bureau. Although the fee in each case is 5 haikwan taels, or $7.50 Mex. (the specific currency being optional with the applicant), the procedure followed at these offices differs in some particulars. To obtain registration at Shanghai it is merely necessary to forward two copies of the trade-mark to the American

consulate, one of which is placed on the register at the consulate and the other transmitted to the Maritime Customs with the required fee.

At Tientsin, however, a more complicated system exists. In addition to eight copies of the trade-mark submitted for registration there must be forwarded three certified copies of the United States registration, together with a power of attorney authorizing the American consul general at Tientsin to apply on behalf of the owner. As in Shanghai, the consulate retains a record of the provisional registration in its own files. In either case no consular fee is charged for the assistance in effecting a proper registration.

Emphasis is placed on the fact that provisional registration with the Maritime Customs confers no title to the exclusive use of a trade-mark in China, nor is it even regarded as prima facie evidence of ownership. It is merely what the name implies—a tentative registration which may serve to establish priority whenever definite arrangements for full legal protection are completed.

The customary method of obtaining protection against possible infringement by the Chinese is through official proclamations forbidding the distribution of infringing merchandise. The issuance of such a proclamation may be procured through the consulate general only when the goods are actually on the market, and the proclamation is issued by the magistrate of each locality where such publication is desired. This procedure may be varied by delaying the issue of enjoining proclamations until actual infringement has occurred, and in some localities this is believed to be the more satisfactory method.

The action of the law, however, is not automatic, and the initiative must be taken by the exporter's representative in China when he is convinced that his rights are being invaded. This necessitates vigilance on the part of the distributing agent and the retaining of counsel in order that the details of the case may be handled accurately. As soon as infringement becomes apparent, the assistance of the American consulate should be sought in presenting the case to the local magistrate, who may order the confiscation of the infringing goods and issue a proclamation forbidding their distribution.

To guard against unfair practices on the part of other nationals than the Chinese, the United States has concluded agreements with Great Britain, France, the Netherlands, Belgium, Germany, Italy, Denmark, Japan, and Sweden. By this arrangement redress may be had against the nationals of any of these countries in the consular court or the higher courts of the country of which the defendant is a subject, provided that registration had been secured in that country. In the case of Japan it is necessary that the trade-mark owner lodging complaint be the first registrant; and since the laws of Germany, and, in a modified form, those of Sweden, recognize prior registration as the basis of ownership, it is advisable to secure registration in these countries also before entering the Chinese market. By virtue of the fact that all the countries mentioned are members of the Berne Convention of 1883 for the protection of industrial property, firm names (or "Hong" marks, as they are known in China) are protected irrespective of registration.

Although by the treaty of 1903 China assumed the obligation of protecting American patents on the basis of reciprocity, no law has yet been promulgated to that effect; consequently, no absolute protection can be claimed. It has been customary, however, for those desiring provisional registration to forward two copies of the United States patent to the American consulate general at Shanghai, one of which is filed with the Maritime Customs. The procedure and fee are the same as for securing provisional trade-mark registration. It is understood that patents can not be filed at Tientsin.

The advantage of such registration is that it enables the injured party to appeal on a more substantial basis to the Chinese authorities in case of infringement; but it is thought that action can be obtained even though the patent is not recorded at Shanghai.

With the exception of Japan, American agreements with the other countries relative to industrial property protection in China do not apply to patents. In view of this situation, the possibility of prosecuting infringement of American patents in China by nationals other than Chinese or Japanese is at present uncertain.

The question of industrial property rights in Hongkong is governed by a separate law based on that of Great Britain. Since, under the English law, ownership in a trade-mark is determined by prior use, registration in Hongkong is not urgent. The laws of Japan extend to Korea and the Japanese leased territory in Manchuria; therefore, registration in Japan is sufficient to cover these areas.

DETAILED STATISTICS OF MACHINERY TRADE.

The following tables show the exports of machinery (according to official American statistics) from the United States to the various countries and territories discussed in the preceding portions of this chapter:

EXPORTS FROM UNITED STATES TO CHINA.

Classes.	1910 [1]		1913 [1]		1915 [1]	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery						545
Cotton gins			2	682	4	1,416
Elevators and elevator machinery				233		9,882
Stationary gas engines			34	6,362	10	944
Gasoline engines:						
Marine			32	11,577	29	8,280
Stationary			6	1,014	6	2,718
Steam engines:						
Locomotives	10	102,755	9	129,075	12	148,897
Marine					2	2,810
Stationary	65	11,881	3	802		
Traction					1	1,908
All other engines	1	300			4	4,662
All other parts of engines		14,091		8,552		12,058
Flour and grist mill machinery				29,572		43,788
Power laundry machinery		171		1,194		13
Metal-working machinery		6,339		3,192		25,321
Oil-well machinery						2,586
Other mining machinery		59,211				
Pumps and pumping machinery		9,893		10,827		21,715
Refrigerating, including ice-making, machinery				733		26,854
Shoe machinery		6,759		100		
Textile machinery				2,904		450
Sawmill machinery				786		1,618
Other woodworking machinery		4,218		867		19,980
All other machinery and parts of		426,114		51,959		76,601
Total		641,732		260,431		414,046

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.

EXPORTS FROM UNITED STATES TO CHINA—Continued.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		35,345		53,230		127,098
Brewers' machinery				19,050		
Concrete mixers		3,010		42,111		9,765
Cotton gins	1	90		20,445		1,299
Elevators and elevator machinery		46,960		28,102		62,387
Electric locomotives	10	500,000	3	90,150	2	10,800
Stationary gas engines	50	44,131	85	20,594	11	18,447
Gasoline engines:						
Automobile	5	1,470	5	1,675		
Marine	117	79,597	75	60,867	44	59,867
Stationary	71	45,705	270	135,674	106	27,668
Traction	7	13,091	14	29,814		
Kerosene engines	81	44,529	122	40,829	14	10,068
Steam engines:						
Locomotives	48	2,406,692	86	3,370,510	104	5,119,837
Marine	12	71,559	10	56,636	3	48,579
Stationary	83	90,417	34	364,731	26	106,425
Traction	2	3,576				
All other engines	70	110,160	112	158,837	13	50,996
Boilers		686,487		345,950		148,897
All other parts of engines		585,058		1,106,001		311,177
Excavating machinery		177				1,991
Flour and grist mill machinery		673,101		539,032		557,645
Power laundry machinery		14,920		18,644		4,139
Lathes		171,115		241,433		121,253
Other machine tools		43,832		413,039		38,054
Sharpening and grinding machines		17,953		55,317		23,766
All other metal-working machinery		1,127,533		222,562		188,111
Oil-well machinery		13,500		32,505		26,743
Other mining machinery		132,985		40,966		131,325
Paper and pulp mill machinery		4,163		48,418		120,640
Pumps and pumping machinery		334,968		445,026		341,510
Refrigerating, including ice-making, machinery		70,294		93,421		106,424
Road-making machinery		17,804		15,135		
Shoe machinery				2,679		3,414
Sugar-mill machinery				28,079		13,012
Textile machinery		3,073,571		3,798,673		7,978,751
Sawmill machinery		9,936		27,663		19,164
Other woodworking machinery		33,068		71,388		122,761
All other machinery and parts of		1,642,242		3,163,728		2,272,965
Total		12,149,039		15,202,914		18,184,978

EXPORTS FROM UNITED STATES TO HONGKONG.

Classes.	1910		1913		1915	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery						161
Elevators and elevator machinery				2,155		3,072
Stationary gas engines			11	1,750	13	1,328
Gasoline engines:						
Marine			3	568	4	853
Stationary			6	1,378	1	1,792
Steam engines, stationary	26	6,639	2	507		
All other parts of engines		8,693		52,398		3,412
Flour and grist mill machinery						1,100
Power laundry machinery		137		400		1,731
Metal-working machinery		2,040		59		
Pumps and pumping machinery		3,705		9,635		4,228
Refrigerating, including ice-making, machinery				629		6,380
Shoe machinery		1,927		3,665		450
Sugar-mill machinery						1,000
Textile machinery				16,441		18,375
Sawmill machinery				334		
Other woodworking machinery		198		2,916		500
All other machinery and parts of		65,544		20,532		29,882
Total		88,883		113,367		74,264

EXPORTS FROM UNITED STATES TO HONGKONG—Continued.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		4,007		577		23,061
Concrete mixers				5,917		
Elevators and elevator machinery		17,332		732		1,549
Stationary gas engines	62	10,293	3	998		
Gasoline engines:						
Automobile	5	1,868	18	3,526	1	487
Marine	73	54,466	70	66,323	22	9,414
Stationary	49	27,454	33	40,812	8	5,523
Traction			1	3,303		
Kerosene engines	3	2,761	12	4,646	3	3,750
Steam engines:						
Locomotives	1	7,464			5	89,312
Marine	2	161,600			2	1,667
Stationary	2	2,044	2	10,370	5	17,950
All other engines	10	27,412	58	90,146	4	19,562
Boilers		7,799		18,104		21,386
All other parts of engines		74,870		83,126		10,380
Excavating machinery		430				
Flour and grist mill machinery		601		20,040		100
Power laundry machinery		467		204		335
Lathes		26,866		19,362		6,948
Other machine tools		9,951		61,011		57,556
Sharpening and grinding machines		1,447		2,485		866
All other metal-working machinery		19,393		114,480		46,081
Oil-well machinery				1,260		23,871
Other mining machinery		941		3,653		405
Paper and pulp mill machinery		1,421		2,022		100
Pumps and pumping machinery		16,004		16,518		39,906
Refrigerating, including ice-making, machinery		7,502		65,709		37,236
Road-making machinery		5,900		11,700		4,250
Shoe machinery		83		152		
Sugar-mill machinery		1,034		4,806		7,492
Textile machinery		55,503		135,350		62,877
Sawmill machinery		4,284		96,945		5,343
Other woodworking machinery		1,237		5,320		22,510
All other machinery and parts of		168,340		334,860		219,722
Total		720,774		1,224,457		739,639

EXPORTS FROM UNITED STATES TO KWANTUNG (JAPANESE) LEASED TERRITORY.

Classes.	1910		1913		1915	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Elevators and elevator machinery				14,530		
Gasoline engines:						
Marine			2	187		
Stationary					1	83
Steam engines:						
Marine					1	3,310
Stationary	5	700				
Traction					1	5,110
All other parts of engines				450		12,912
Flour and grist-mill machinery				1,076		
Power laundry machinery				560		
Metal-working machinery				120		6,559
Other mining machinery		11,508		6,463		
Pumps and pumping machinery		4,034		2,263		16
Refrigerating, including ice-making, machinery				30		
Textile machinery						54
All other machinery and parts of		9,480		11,167		59,545
Total		25,722		36,846		87,589

EXPORTS FROM UNITED STATES TO KWANTUNG—Continued.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery				60,754		12,983
Concrete mixers						
Elevators and elevator machinery						820
Electric locomotives	1	55,096	14	201,900		
Stationary gas engines			1	513		
Gasoline engines:						
Marine			5	1,102	6	2,725
Stationary					3	1,068
Traction	1	2,670	2	2,600		
Kerosene engines			1	300		
Steam engines:						
Locomotives	57	3,056,840	11	478,435		
Stationary			1	22,318		
All other engines				10,900	2	160
Boilers		8,447		55,297		3,305
All other parts of engines		251,845		98,756		110,906
Excavating machinery		1,288				
Flour and grist mill machinery				301		143,034
Lathes		10,092		42		
Other machine tools		5,425		698		868
Sharpening and grinding machines		168		1,255		5,192
All other metal-working machinery		16,015		8,626		1,392
Oil-well machinery				13,290		568
Other mining machinery		2,043		8,935		5,677
Pumps and pumping machinery		2,185		6,663		1,100
Refrigerating, including ice-making machinery		17,090		7,200		
Road-making machinery		26,220				5,555
Shoe machinery				100		
Textile machinery				38,925		320,235
Sawmill machinery		504		899		502
Other woodworking machinery				4,990		
All other machinery and parts of		145,710		277,708		144,361
Total		3,601,550		1,302,507		760,451

EXPORTS FROM UNITED STATES TO FRENCH INDO-CHINA.

Classes.	1910		1913		1915	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Gasoline engines: Stationary			1	82		
Metal-working machinery				1,645		
All other machinery and parts of				1,277		495
Total				3,004		495

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		7,446		195		410
Cotton gins				470		
Elevators and elevator machinery		608				
Gasoline engines:						
Automobile			1	225		
Marine	13	2,588	3	4,903		
Stationary	3	2,531	5	1,859		
Traction	2	1,552	73	58,024		
Kerosene engines	1	400				
Steam engines:						
Marine	1	5,438				
Stationary	7	6,847	4	7,114	1	7,974
Traction	2	2,870				
All other engines	4	10,803				
Boilers		20,150		2,100		
All other parts of engines		13,499		2,976		854
Lathes		753		1,725		

EXPORTS FROM UNITED STATES TO FRENCH INDO-CHINA—Continued

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Other machine tools		70		108		276
Sharpening and grinding machines		1,266		944		
All other metal-working machinery		3,696		205		200
Oil-well machinery		9,830		12,334		
Other mining machinery		1,783				
Pumps and pumping machinery		2,066		3,841		
Refrigerating, including ice-making, machinery		150				
Road-making machinery						1,200
Sugar-mill machinery		70		33,927		
Textile machinery				275		
Sawmill machinery		546		114		
Other woodworking machinery		224		1,239		
All other machinery and parts of		90,589		26,337		19,382
Total		189,775		158,915		30,296

EXPORTS FROM UNITED STATES TO SIAM.

Classes.	1910		1913		1915	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Elevators and elevator machinery				376		
Stationary gas engines					13	1,798
Gasoline engines:						
Marine			2	240	25	2,296
Stationary			2	277	5	4,286
Steam engines:						
Locomotives			1	3,560	1	3,823
Marine					2	334
Stationary	2	350			2	11,615
All other engines					2	8,854
All other parts of engines				390		502
Flour and grist mill machinery				87		
Power laundry machinery		20		36		
Metal-working machinery				870		354
Other mining machinery		212		133		
Pumps and pumping machinery		1,090		3,019		1,923
Refrigerating, including ice-making machinery				293		1,988
Shoe machinery				47		
Sawmill machinery						1,549
Other woodworking machinery						142
All other machinery and parts of		7,136		433		1,975
Total		8,808		9,761		41,439

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		100				
Concrete mixers						
Elevators and elevator machinery						3,208
Stationary gas engines	3	3,437	2	946	1	175
Gasoline engines:						
Automobile						1,067
Marine	82	71,365	20	19,246	6	2,336
Stationary	14	4,010	14	4,046	4	580
Traction	3	8,047	12	19,588	2	7,562
Kerosene engines	5	4,460	5	8,721		
Steam engines:						
Locomotives						
Stationary			1	2,202		
All other engines	22	21,331	3	11,660	1	1,080
Boilers						1,629
All other parts of engines		11,168		10,204		9,961
Excavating machinery		5,811				7,626

EXPORTS FROM UNITED STATES TO SIAM—Continued.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Flour and grist mill machinery		3,754		455		
Lathes		441		705		336
Other machine tools		1,695		422		1,781
Sharpening and grinding machines		1,941		644		1,772
All other metal-working machinery		2,062		729		3,301
Other mining machinery		2,748		14,385		1,260
Paper and pulp mill machinery						36,274
Pumps and pumping machinery		6,874		5,670		5,352
Refrigerating, including ice-making, machinery		755		30,425		5,353
Road-making machinery		1,160				7,693
Shoe machinery				40		
Sugar-mill machinery						30
Sawmill machinery		1,981		7,281		4,364
Other woodworking machinery						7,167
All other machinery and parts of		57,953		17,722		70,887
Total		214,129		155,091		180,794

EXPORTS FROM UNITED STATES TO RUSSIA IN ASIA.

Classes.	1910		1913		1915	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery						625
Cotton gins					10	4,308
Elevators and elevator machinery						2,978
Electric locomotives					1	2,130
Stationary gas engines			2	650	24	197,373
Gasoline engines:						
Marine			4	362	4	274
Traction			1	881		
Steam engines:						
Locomotives					20	310,000
Stationary	74	27,774				
Traction					1	1,125
All other engines			1	500	1	161
All other parts of engines		4,124				2,576
Flour and grist-mill machinery				141		46,069
Power laundry machinery				25		
Metal-working machinery		242		1,600		365,389
Other mining machinery		726		33,252		122,378
Pumps and pumping machinery		1,497		962		7,425
Sawmill machinery						346
Other woodworking machinery				45		13,032
All other machinery and parts of		26,632		11,502		227,436
Total		60,995		49,920		1,303,625

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		7,134		2,540		
Stationary gas engines			1	500		
Gasoline engines:						
Marine	15	90,393	17	38,945	14	5,158
Stationary			11	4,674		
Traction	2	7,500				
Kerosene engines	3	4,983				
Steam engines:						
Locomotives	79	3,416,893				
Marine	1	700	1	1,600		
Stationary	13	2,490				
Traction	9	6,616				
All other engines	1	1,643	22	7,791		
Boilers		49,990		21,591		

EXPORTS FROM UNITED STATES TO RUSSIA IN ASIA—Continued.

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
All other parts of engines		4,759,547		37,483		114,612
Power laundry machinery				55		
Lathes		19,082		3,966		
Other machine tools		100,678				
Sharpening and grinding machines		995		640		
All other metal-working machinery		37,085		2,730		
Oil-well machinery		68,785				
Other mining machinery		78,121		22,861		92
Pumps and pumping machinery		201,283		623		144
Refrigerating, including ice-making, machinery		38,500				
Shoe machinery				350		
Textile machinery		12,000				
Sawmill machinery		29		366		
Other woodworking machinery		40,373		12,327		450
All other machinery and parts of		270,565		236,268		3,287
Total		9,215,389		395,310		123,743

The tables below show the exports of machinery (according to British statistics) from the United Kingdom to China proper and to Hongkong, excluding agricultural machinery, typewriters, sewing machines, etc. The figures are in pounds sterling; the equivalent of the pound in United States currency can be taken as about $4.86 up to 1915 and as about $4.70 from that time to 1918, after which it underwent a severe decline and fluctuated widely.

EXPORTS OF MACHINERY FROM UNITED KINGDOM TO CHINA.[1]

Classes.	1909	1910	1911	1912	1913	1914
Locomotives	£20,531	£62,904	£49,766	£5,882	£10,270	£31,872
Pumping machinery	11,946	35,369	6,170	7,152	2,344	9,662
Unenumerated prime movers	22,507	37,499	21,762	23,803	37,105	55,700
Electric motors and generators } Other electrical machinery }	19,439	35,867	25,592	23,830	28,704	39,179
Boilers	24,985	20,299	16,226	32,924	42,113	42,741
Spinning machinery	} 61,870	140,785	29,599	56,937	134,561	191,877
Weaving machinery						27,310
Other textile machinery						9,576
Mining machinery	1,958	3,054	4,941	2,007	1,087	
Unenumerated	58,669	96,412	75,659	59,780	82,736	76,624
Total	221,905	432,189	229,715	212,315	338,920	484,541

Classes.	1915	1916	1917	1918	[2] 1919	[2] 1920
Locomotives	£11,700	£6,619	£4,225	£4,205	£7,847	£100,113
Pumping machinery	1,223	6,178	7,825	8,159	21,773	33,994
Unenumerated prime movers	9,182	5,652	1,241	3,149	37,396	111,456
Electric motors and generators	13,443	29,841	12,999	16,251	28,930	66,306
Other electrical machinery	5,724	6,726	4,770	8,617	12,992	45,327
Boilers	32,450	27,478	49,398	18,419	74,879	118,032
Spinning machinery	89,023	177,386	130,632	154,635	188,497	246,582
Weaving machinery	18,189	11,151	10,210	13,480	33,851	43,999
Other textile machinery	3,632	1,015	1,738	1,296	2,207	10,178
Unenumerated	38,122	49,014	47,407	28,208	150,360	786,308
Total	222,688	321,060	270,445	256,419	558,732	1,562,295

[1] This excludes shipments to Hongkong, Macao, and the leased territories and thus corresponds as closely as may be to that part of China between Chinwangtao and Santuao. See China data on p. 262.

[2] A change in classification introduced in 1919 makes comparison with the earlier years very difficult, and it may be that the above statement is not strictly accurate in view of the classification adopted.

EXPORTS OF MACHINERY FROM UNITED KINGDOM TO HONGKONG.

Classes.	1909	1910	1911	1912	1913	1914
Internal-combustion engines Unenumerated prime movers	£13,501	£14,185	£10,336	£14,689	£36,978	£20,443
Electric generators and motors Unenumerated electrical machinery	19,379	16,270	7,846	10,743	12,582	17,349
Other unenumerated machinery	31,543	31,366	27,366	17,740	26,546	25,360
Total	64,423	61,821	45,548	43,172	76,106	63,152

Classes.	1915	1916	1917	1918	1919	1920
Internal-combustion engines	£3,826	£5,182	£4,462	£215,596	£9,463	£30,921
Unenumerated prime movers	3,237	11,968	7,766	19,922	19,155	1,143
Electric generators and motors	6,609	8,611	4,427	10,178	11,288	....
Unenumerated electrical machinery	21,773	1,663	4,096	1,338	5,280	8,884
Other unenumerated machinery	21,928	25,604	17,781	38,190	77,847	133,783
Total	57,373	53,028	38,532	285,224	123,033	174,731

Japanese machinery exports are shown below (the yen may be taken as equal to 50 cents):

EXPORTS FROM JAPAN TO CHINA.[1]

Years.	Electrical machinery.	Cotton gins.	Textile machinery.	Lathes.	Other machinery.
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
1910	52,205	179,915	130,212	(2)	132,199
1911	161,349	405,024	120,535	(2)	159,837
1912	170,765	80,646	101,288	(2)	616,159
1913	248,840	121,560	225,302	(2)	384,306
1914	268,278	35,416	303,764	(2)	285,120
1915	254,541	55,848	322,382	(2)	396,115
1916	350,054	(2)	469,321	(2)	554,063
1917	698,331	(2)	466,354	100,354	1,845,236
1918	1,005,068	(2)	1,397,480	161,406	1,913,665
1919	1,409,000	(2)	1,579,000	209,000	3,235,000
1920	1,326,000	(2)	2,542,000	373,000	2,847,000

[1] This excludes Hongkong and Kwantung. Although these figures may include some small items shipped into the treaty ports of South China and Manchuria (excepting Dairen), the territory corresponds as closely as may be to that part of China between Chinwangtao and Santuao. See China data on page 262.
[2] Figures not available.

EXPORTS FROM JAPAN TO KWANTUNG LEASED TERRITORY.

Classes.	1916	1917	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Electrical machinery	276,340	756,890	1,512,619	1,687,000	1,468,000
Textile machinery	10,053	125,965	13,742	297,000	153,000
Lathes	....	131,847	234,111	107,000	109,000
Printing machinery	26,291	28,908	60,819	105,000	163,000
Other machinery and parts	537,491	1,188,613	2,728,771	3,478,000	2,227,000
Total	850,175	2,232,223	4,550,062	5,674,000	4,120,000

NOTE.—It is understood that the above are shipments only to Dairen and Port Arthur. Consignments to Antung, Suifenho, Harbin, Mukden, Chinwangtao, etc., are included in the exports to China.

EXPORTS FROM JAPAN TO HONGKONG.

Classes.	1916	1917	1918[1]	1919	1920
	Yen.	Yen.	Yen.	Yen.	Yen.
Electric machinery and parts	41,225	42,293	61,941	66,000	67,000
Textile machinery and parts	8,024	3,835	3,076	7,000	16,000
Lathes				3,000	
Printing machinery	4,776	16,037	11,107	9,000	23,000
Other machinery and parts	51,471	64,762	294,706	64,000	94,000

[1] In 1918 Japan supplied internal-combustion engines valued at £7,548 c. i. f. Hongkong. It was reported that these included 600 gasoline engines (copies of a well-known American make) to be used by the Allies.

Following are figures for the British colony of Hongkong:

MACHINERY RETURNS OF HONGKONG CUSTOMS.[1]

Classes.	1918			1919		
	From United States.	From United Kingdom	Total from all sources.	From United States.	From United Kingdom	Total from all sources.
Internal-combustion engines	£19,292	£185,798	£216,754	[2] £67,857	£5,173	£92,799
Steam engines	3,995	6,987	11,285	21,871	4,825	27,423
Steam boilers	241	47,123	47,670	7,381	6,809	15,652
Electrical machinery	155,030	9,796	175,420	83,090	14,565	110,951
Industrial	14,188	1,764	25,564	37,398	25,215	76,896
Mining	704	32	1,406	122		122
Pumping	3,245	9,737	14,122	6,462	30,918	38,991
Ship	210	83,912	85,299	5,118	43,469	57,995
Sugar	116		116	258	137	395
Textile	73	5	4,470	[3] 259		11,326
Machine tools	8,705	851	16,069	20,617	42,364	63,185
Sundry	40,048	23,401	68,618	22,034	50,415	84,692
Total	245,847	369,406	666,793	272,467	223,890	580,427

Classes.	1920			1921		
	From United States.	From United King-dom.	Total from all sources.	From United States.	From United King-dom.	Total from all sources.
Internal-combustion engines	£41,584	£24,919	£89,362	£35,995	£32,659	£77,889
Steam engines	694	2,883	3,577	3,303	86,390	89,699
Steam boilers	6,774	47,762	56,147	10,233	81,610	93,293
Electrical machinery	47,589	42,266	109,537	48,673	111,843	170,869
Industrial	69,511	30,091	121,234	95,192	51,386	180,685
Mining	40	1,286	1,636	5,565	32	5,597
Pumping	4,915	22,858	28,713	8,035	74,718	86,613
Ship	1,559	55,736	58,261	326	139,217	157,114
Sugar		2,116	2,116	4,564	8,486	13,050
Textile	5,959	267	7,268	3,583	143	6,177
Machine tools	20,658	123,971	146,819	14,729	124,834	143,811
Sundry	20,266	52,984	91,918	33,928	48,542	95,214
Total	219,549	407,139	716,588	264,126	759,860	1,120,011

[1] Earlier data not available.
[2] In 1919 Canada supplied internal-combustion engines valued at £3,557. Possibly all of these were manufactured in the United States.
[3] In 1919 the Philippine Islands supplied "textile machinery" valued at £9,214. In 1918 Canada supplied £3,472.

MACHINERY IMPORTED INTO HONGKONG FROM JAPAN. (FROM HONGKONG RETURNS).

Years.	Imports.	Exports.
1918	£23,311	£1,658
1919	11,974	280
1920	19,878	2,929

JAPAN.

RELATIVE IMPORTANCE OF JAPANESE MARKET.

The total value of American industrial machinery imported into Japan as compared with other Asiatic countries is indicated by figure 40, from which it will be noted that during the past decade Japan has absorbed as much American machinery as China, India, and the Netherlands East Indies combined.[1]

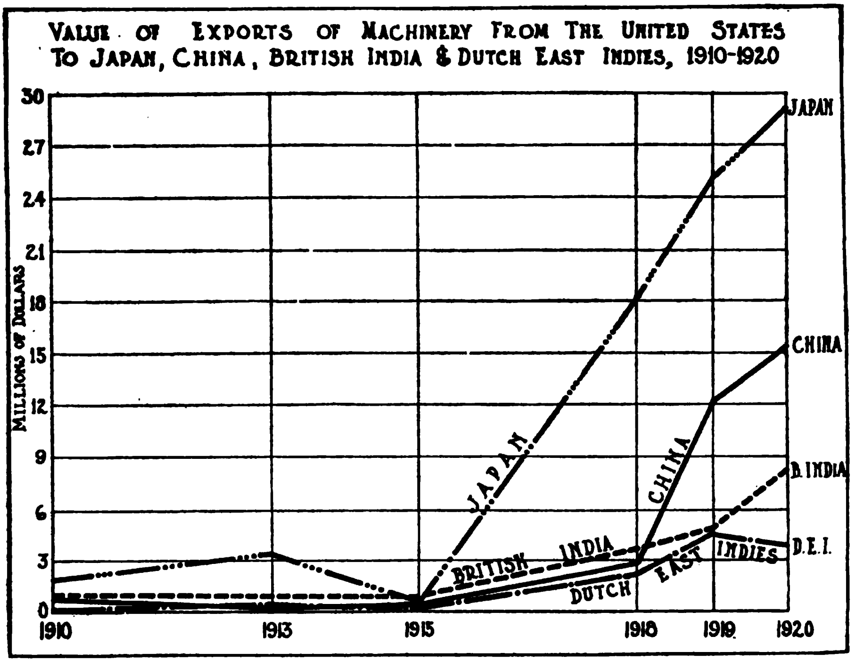
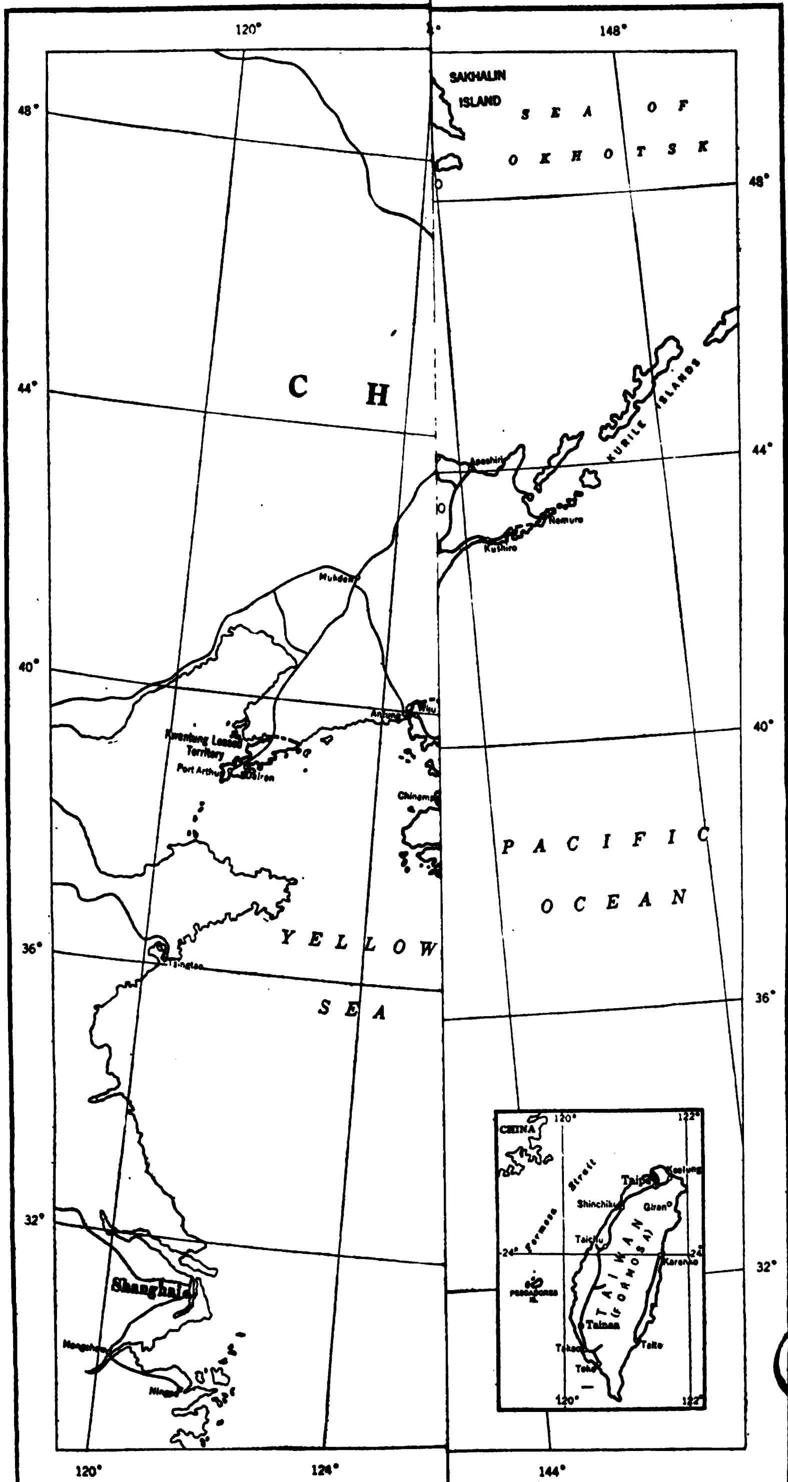


FIG. 40.

It is not so easy to make a similar comparison with the non-Asiatic countries because the circumstances are often very different. Although the markets of Europe have commonly absorbed from 30 to 50 per cent of our machinery exports, the war has profoundly influenced our European trade, and our markets there have been shrinking since the armistice in 1918. Generally speaking, it would seem wise for the American manufacturer to devote his greatest efforts to those markets that are expanding, which are largely in certain countries of Latin America and Asia. Corresponding to the above diagram, figure 41 (on the next page), shows the value of the ma-

[1] The values represented by the Japan line in figure 40—exports of industrial machinery from the United States to Japan (from returns of United States customs)—are: 1910, $1,741,402; 1913, $3,314,435; 1915, $690,114; 1918, $18,258,141; 1919, $25,021,786; 1920, $29,241,699. For full retails see the tables beginning on page 330.


120°
148°
48°
44°
40°
36°
32°
124°
144°
SAKHALIN
ISLAND
SEA OF
OKHOTSK
C H
KURILE ISLANDS
Nemuro
Kushiro
Mukden
Kwantung Leased
Territory
Port Arthur
Dairen
Chinampo
PACIFIC
OCEAN
YELLOW
SEA
Tsingtao
Shanghai
Ningpo
CHINA
Strait
Formosa
Taipeh
Keelung
Shinchiku
Giran
Taichu
TAIWAN
(FORMOSA)
Karenko
PESCADORES
IS.
Tainan
Takao
Taito
122°
24°

chinery exports from the United States to the more important of the Latin American countries.

The postwar depression has been particularly severe in Cuba and some of the other Latin American countries, but Japan was the first to experience this collapse and possibly it may be said that it is the first to recover. Our trade with Japan has suffered less from exchange fluctuations than has been the case with most other countries. Clearly Japan ranks very high among our foreign markets for machinery and is probably more important than any other country except Canada and the nations in Europe.

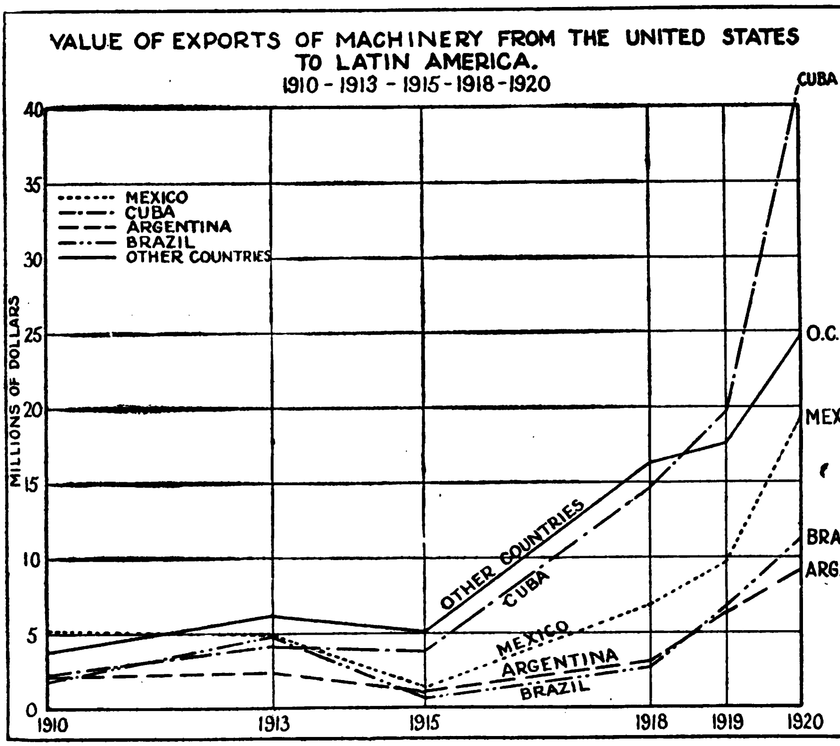


FIG. 41.

The charts presented above refer only to exports from the United States. The data in the table following, showing industrial-machinery imports into Japan, are from the returns of the Japanese customs and, in addition to verifying more or less satisfactorily the above, they also indicate the extent of American participation in this trade; it will be noted that great changes have taken place during the decade.

Years.	Total value.	Percentage from the United States.	Percentage from the United Kingdom.
	Yen.		
1910	14,987,000	20.1	61.5
1913	28,884,000	24.3	46.7
1915	8,221,000	24.4	44.1
1918	39,916,000	77.7	15.9
1919	64,934,000	75.4	22.6

It will be noted that the above percentage figures do not check with those on page 6 and in publications written by others. This is because of a different selection of classifications. In the above, sewing machines, agricultural implements, etc., have been omitted. The classifications made are given in detail on pages 289 and 290. When the regular Japanese grouping is used the figures become:

Years.	Total value.	Percentage from the United States.	Percentage from the United Kingdom.
	Yen.		
1918	58,497,998	80.0	17.9
1919	89,221,936	75.0	18.0
1920	110,571,378	66.5	25.7
1921	96,304,000	52.9	36.7

NOTE.—Details as to the participation of each class of machinery are given, as far as the customs returns permit, in the section beginning on p. 321.

It will be noted that even in 1910 the United Kingdom and the United States together supplied 81.6 per cent of the machinery imports, and in 1913 their total was 71 per cent. Since the armistice this total has been much higher, so that the bulk of the trade has been divided between these two sources. The nature of the competition varies according to the type of machinery. Before the war American manufacturers supplied such machinery as electrical and ice-making equipment, while the British were especially strong in the textile and certain other fields. During the three years 1918, 1919, and 1920, the United States shipped nearly $13,000,000 worth of textile machinery to Japan, so that it may be anticipated that the American participation in this business will be much more active than formerly. Corresponding changes are also to be anticipated in other directions.

NATURE OF MACHINERY IMPORTED.

The classes of machinery imported as indicated by the figures above are given in detail in the succeeding tables, showing total machinery imports to Japan. As the trade in 1919 was more than four times the volume of 1910, it might be expected that all classes would show a tendency to increase, but it is interesting to note how the depression of 1915 and the subsequent boom influenced each particular class:

[000 omitted.]

Classes.	1910	1913	1915	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Steam boilers	485	976	570	7,535	8,335	6,680
Economizers		146	62	131	272	613
Locomotives	154	2,387	228	398	408	914
Road rollers, etc		35	9		23	180
Steam turbines	149	64	24	275	836	1,701
Steam engines	605	569	54	463	540	491
Gas engines, etc	521	1,216	163	501	966	4,771
Water turbines, etc		729	116	82	1,787	779
Dynamos, motors, etc	1,208	3,659	501	3,031	5,245	6,080
Direct-connected generators		631	248	485	736	684
Other motive machinery		2			2	5
Cranes	326	1,079	40	511	631	732
Capstans, etc		429	138	375	298	577
Gas compressors		298	129	1,029	1,080	1,848
Pumps	518	1,081	267	839	1,383	1,594
Blowing machines		312	88	190	329	270
Hydraulic presses	234	35	23	247	220	563
Metal or wood working	1,313	3,279	2,481	6,641	10,563	13,650
Spinning	2,648	5,070	1,336	8,557	13,864	18,163
Looms	1,108	850	344	657	1,391	1,374
Tissue-finishing	59	624	72	29	305	716
Knitting	43	138	8	151	623	314
Paper-making	366	189	191	1,120	2,928	3,219
Ice-making	147	107		15	125	375
Pneumatic tools			100	735	907	637
All others	5,103	4,979	1,029	5,919	11,137	15,665
Total	14,987	28,884	8,221	39,916	64,934	82,595

The table below shows the American participation in the above trade during the same years and according to the same classifications. Although the Japanese machinery imports expanded 5½ times between 1910 and 1920, it will be noted that the volume of the American trade expanded 18 times and in many classes of equipment accounts for a very large part of the total. Even in cotton-spinning machinery American manufacturers sometimes supplied more than 50 per cent of the total. It is therefore probable that the market will incline more toward American machinery during the next few years than it did just before the war. Imports of machinery from the United States have been:

[000 omitted.]

Classes.	1910	1913	1915	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Steam boilers	18	77	52	6,015	5,626	3,358
Economizers				70	211	222
Locomotives	61	1,666	88	398	408	898
Road rollers						164
Steam turbines	50	16	23	275	588	1,521
Steam engines	194	28	3	415	367	170
Gas engines, etc	19	80	35	476	757	818
Water turbines, etc	136		21	32	15	460
Dynamos, motors, etc	902	1,448	327	2,975	4,763	5,485
Direct-connected generators		258	63	483	431	529
Other motive machinery					2	5
Cranes	41	173	21	418	607	695
Capstans, etc		44	55	329	270	436
Gas compressors		146	90	997	1,037	1,584
Pumps	182	272	57	678	1,059	1,251
Blowing machines		137	48	158	234	191
Hydraulic presses	11	1	15	101	180	446
Metal or wood working	253	783	483	6,281	9,973	10,964
Spinning	10	34	40	4,810	7,693	7,477
Looms	37	4		27	478	519
Tissue-finishing		73	4	4	201	262
Knitting	1	17		149	593	270
Paper-making	141	12	32		2,350	2,522
Ice-making	112	42		15	125	375
Pneumatic tools			94	689	837	618
All others	911	1,695	545	5,222	10,083	13,642
Total	3,079	7,006	2,096	31,017	48,888	54,882

The figures on page 288 show that British machinery was popular in this market before the war and was in a leading position up to 1915. In order that full comparison may be made, a third table is submitted below, showing imports of British machinery into Japan. Even at the end of 1920, two years after the armistice, the British trade had not expanded very greatly, for in view of the high unit costs it seems probable that the amount of machinery as expressed in tons or units was not far above the 1913 level.

[000 omitted.]

Classes.	1910	1913	1915	1918	1919	1920
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Steam boilers	462	660	499	1,285	2,636	2,929
Economizers	....	142	61	60	60	391
Locomotives	21	43	....	....	....	6
Road rollers, etc	....	23	9	....	3	16
Steam turbines	62	20	....	....	....	91
Steam engines	397	219	51	22	121	222
Gas engines, etc	448	577	42	1	38	3,254
Water turbines, etc	29	37	24	....	637	....
Dynamos, motors, etc	600	782	131	38	187	376
Direct-connected generators	....	254	185	....	....	16
Other motive machinery	....	2	....	....	2	....
Cranes	256	426	20	34	23	37
Capstans, etc	....	351	72	21	....	134
Gas compressors	....	107	15	24	39	128
Pumps	287	612	182	116	172	256
Blowing machines	....	112	37	14	48	55
Hydraulic presses	218	29	8	146	40	116
Metal or wood working	933	1,895	279	251	484	2,573
Spinning	2,521	4,812	1,284	3,270	4,734	10,499
Looms	909	495	291	629	897	751
Tissue-finishing	....	548	68	24	104	337
Knitting	5	8	....	1	....	....
Paper-making	204	71	13	8	324	373
Ice-making	17	65	....	....	....	....
Pneumatic tools	....	....	6	5	16	3
All others	1,843	1,209	351	403	484	1,458
Total	9,212	13,499	3,628	6,352	11,049	24,021

From all of the above it is clear that Japan is one of the most important of the world's markets for American machinery, and the trade there should be cultivated with great care. As the market is of such outstanding importance, foreign competition is keen, and American machinery should be supported by adequate advertising and salesmanship—not merely for protection but also to increase the participation of Americans in the machinery trade of Japan.

DESCRIPTION OF TERRITORY.

JAPAN PROPER.

American machinery manufacturers are more familiar with Japan and its markets than with any other country of Asia. The general contour and location of the archipelago is indicated on the map at the beginning of this section, which, for purposes of comparison, is superimposed upon a map of the States of Indiana and Ohio, carefully drawn to the same scale. The area of Japan proper is 148,756 square miles, which may be compared with that of New England, New York, New Jersey, and Pennsylvania (168,978 square miles), but has a population of 55,961,140—almost double that of the above-mentioned States, which is 29,660,524. The States of Ohio and Indiana together have an area of 77,394 square miles and a population

of 8,689,912. In general Japan is mountainous and deficient in resources. Further comparison with the Philippine Archipelago, the Malay Peninsula, the Netherlands East Indies, etc., can be made with the corresponding maps as published in this report.

TAIWAN (FORMOSA).

In addition to the territory of Japan proper, the Empire includes territories acquired since 1890. The oldest of these is Formosa (Taiwan), which was ceded by China in 1895. Its area is 13,840 square miles (half the size of Ceylon, 25,481 square miles), and compares with that of Maryland, 12,327 square miles. The population is 3,654,389—more than double that of Maryland, 1,449,661 (Ceylon, 4,106,350)—only 4 per cent (148,831) being Japanese. Under Japanese control this territory has been developed rapidly. It is sometimes said that Taihoku is the finest city in the Japanese Empire. The commercial expansion of the island is shown by the following returns of its foreign trade (including shipments to and from Japan):

	Yen.		Yen.
1911	118, 112, 000	1918	243, 575, 591
1912	119, 423, 000	1919	332, 535, 771
1913	114, 230, 000	1920	388, 701, 675
1917	234, 691, 094		

In other words, Formosa in 1920 had a maritime trade greater than that of all Japan in 1897. Those who consider Asia the "unchanging East" will do well to remember this expansion, as it is more or less representative of developments from Vladivostok to Port Said.

The eastern part of the island is mountainous and covered with forests in which dwell several tribes of savage head-hunting aborigines. It is from this district that practically all of the world's supply of camphor is drawn. The world's supply of Oolong tea is produced on the northern part of the western plain, while in the south is an area devoted to the production of sugar cane which is crushed in some 35 large plants, each of which is understood to have a capacity of 500 tons of cane per day or more. The ownership of these plants is concentrated in 11 different companies. Formosa also produces gold, copper, silver, petroleum, sulphur, and coal; the most important of these is the last named, the production of which has been: 1916, 514,000 tons; 1917, 673,000 tons; 1918, 801,000 tons. The quality is inferior to that of Japanese coal.

CHOSEN (KOREA).

Chosen (Korea) was annexed in 1910. It has an area of 85,228 square miles, somewhat more than that of Indiana and Ohio combined, and the population is 17,284,207, of which, in 1917, 332,456 were Japanese. As in the case of Formosa, the foreign trade has been expanding very rapidly:

	Yen.		Yen.
1909	52, 897, 000	1915	108, 691, 000
1910	59, 696, 000	1916	131, 258, 000
1911	72, 944, 000	1917	186, 661, 000
1912	88, 101, 000	1918	312, 498, 000
1913	102, 459, 000	1919	500, 452, 000
1914	97, 620, 000	1920	430, 915, 000

Such progress is important. The trade of the peninsula in 1919 was greater than the entire foreign trade of Japan in 1900.

The products of Korea are largely of the more common types of agricultural produce, but the fisheries are also important and the minerals produced include gold, iron, graphite, and coal. The coal production has been as follows: 1914, 183,000 tons; 1915, 229,000 tons; 1916, 190,000 tons; 1917, 195,000 tons; 1918, 188,000 tons. Of the 1917 production, 154,000 tons were from the Pyongyang collieries, this coal being reported to be a friable anthracite that is briquetted for stoking.

JAPANESE SAKHALIN.

Japanese Sakhalin has an area of about 13,155 square miles, but the population is only 105,765, almost all of whom are Japanese. This territory has not been developed very actively but has important fisheries. An important lumber trade has been established and there are four good-sized pulp mills in operation. It is reported that an important coal mine has been developed at Kawakami. The production in 1914 was only 14,653 tons but is said to have expanded very much since then. The quality is said to compare with that of Hokkaido coal.

INTERESTS IN MANCHURIA.

In Manchuria the Japanese have a lease on part of the Liaotung Peninsula at Dairen and Port Arthur. They also have the South Manchuria Railway from Dairen and Port Arthur to Changchun north of Mukden, as well as the line from Mukden to Antung, where the railway passes into Korea. This lease also includes the zone through which this railway operates. The larger part of the trade of this region passes through Dairen and is expanding rapidly. Several important coal mines are under Japanese control in this region, the production being reported as follows:

Year ended March—	Fushun.	Yentai.
	Tons.	*Tons.*
1917	2,275,905	113,679
1918	2,521,164	106,368
1919	2,928,186	110,167

Okura & Co. have a mine at Penchihu that is reported to produce 500 tons per day.

The quality of these Manchurian coals is not so good as that of other grades found farther south.

RAILWAYS.

Japan proper has more than 6,000 miles of railways under Government management. This represents greater development than is to be found elsewhere in Asia; in fact, it will be noted that the total mileage for Japan, with its small area and population, approximates that of China and is, roughly, 20 per cent that of India. In addition, Formosa has 355 miles and Sakhalin 65 miles. All the above lines are of 42-inch gauge.

In Korea the railways are built to a gauge of 4 feet 8½ inches, and have equipment that is almost entirely American, in which respect they resemble the railways of Manchuria, with which they connect. These lines in Korea are operated by the South Manchuria Railway, so that they practically form a part of that system. Since the Japanese Government owns 51 per cent of the stock of the South Manchuria Railway, these roads are almost Government lines. Owing to the fact that the equipment of the lines in Korea and Manchuria conforms so closely to American practice, little difficulty will be experienced in handling bulky packages of reasonable dimensions there, but in Japan, Formosa, and Sakhalin the capacity of the lines is that of a road of 42-inch gauge built, in general, on a European pattern. Most of the freight cars are of the four-wheel type with hook and chain couplers, and seldom have a capacity of more than 15 tons. Those of the box-car type have small doors, and the clearances are restricted. The delivery of a 10,000-kilowatt steam turbine over the Japanese Government railways involves very careful study if one is to escape a difficult and possibly expensive transaction.

Originally the railways of Japan were mostly privately owned, but in 1906–7 the Government absorbed the 17 most important private lines and consolidated the whole into one system, which has been considerably extended. Recently there has been some agitation for further extension, and it has been suggested that some of this be done privately. In some sections the existing railways have been developed to a high standard. The section between Tokyo and Yokohama, for instance, was electrified a number of years ago, and there is some advocacy of the electrification of other sections, thus utilizing some of the water power that may be available for this purpose. In addition to the main railway lines, there are private interurban and city electric lines with a total mileage of 843.

Traffic is increasing rapidly, as is shown by the following returns:

Years.	Passenger-miles.	Ton-miles.
1915	3,023,743,000	2,982,098,000
1916	3,856,537,000	3,309,519,000
1917	4,255,375,000	4,179,135,000
1918	5,515,546,000	5,033,344,000
1919	6,569,442,000	5,608,851,000

These railways have shown some very interesting records. For example, the 18-mile distance between Tokyo and Yokohama is covered in 28 minutes. The distance from Tokyo to Shimonoseki, 704½ miles, is covered in 25 hours and 8 minutes. Because of the contour of the country, these railways are always paralleled by water traffic with which they must compete, and it is possibly surprising that these lines should have so great a traffic or give such good service.

Certain sections of the lines seem to be overloaded. For a long time a plan was discussed for converting the Tokyo-Shimonoseki line to 4-foot 8½-inch gauge. More recently it has been reported that this scheme has been abandoned, but it seems probable that certain parts of the road will be raised to a four-track line.

CITIES WHERE MACHINERY SALES ARE EFFECTED.

When machinery is needed for enterprises in the outlying possessions, buyers frequently return to Japan proper to make their purchases. As a result, Formosa, Korea, etc., are to be included in the territory supplied by the markets in the leading cities of Japan. Some years ago the writer secured a contract for a complete sugar mill for Formosa. This involved about 2,000 tons of equipment, and although sales work had made it necessary to travel the full length of Formosa and other work was done in Kobe the contract was signed and payments were collected in Tokyo. Many of the important contracts are handled in this way.

The more important cities of Japan are:

	Population.		Population.
Tokyo	2, 173, 162	Yokohama	422, 962
Osaka	1, 252, 972	Nagasaki	176, 554
Kobe	608, 628	Shimonoseki	72, 287
Kyoto	591, 305	Moji	71, 741
Nagoya	429, 990		

Moji and Shimonoseki are one city in the same sense that New York and Brooklyn are, but neither is a machinery market of any importance. Nagasaki, Nagoya, and Kyoto also purchase very little machinery, and when they do make such purchases it is customary to consult with dealers in the other cities. The machinery trade of the whole Empire is concentrated in the other four cities.

Kobe originally was the port for Osaka, being about 20 miles distant, but more recently Kobe has developed importance of its own and contains two of the most important shipyards in Japan and many other industries. Osaka has more recently constructed a large harbor and is the most noted manufacturing city in Japan, but the ocean carrying trade still goes to Kobe, and both Tokyo and Kobe are becoming more important as manufacturing centers. As a seaport Kobe is very important and claims in some years to handle more tons of cargo than any other port on the Pacific Ocean, ranking ahead of San Francisco, Shanghai, Hongkong, Sydney, etc., in this respect. Vessels for Formosa, China, Korea, etc., usually sail from Kobe, and a very heavy transshipment trade results. The machinery trade of the Kobe-Osaka-Kyoto district centers in Kobe.

In a similar way Yokohama is the port for Tokyo, being 18 miles distant, but the machinery trade of the Tokyo-Yokohama district centers in Tokyo. The distance from Yokohama to Kobe by sea is about 300 miles and requires about 26 hours. By rail the distance is 376 miles and by the fastest trains requires about 14 hours. From New York to Norfolk, Va., is 347 miles by rail.

On page 6 is a statement, based on the customs returns, indicating that the volume of the machinery imports at Yokohama and Kobe are approximately equal, but this conveys an inaccurate impression, as orders for much of the equipment landed in Kobe are placed in Tokyo. Probably it is safe to estimate that machinery orders placed in Tokyo more than double the value of those placed in Kobe, Osaka, and Kyoto combined. Tokyo also is of superior importance because most of the large firms selling machinery in Japan have their main offices there. As a consequence, Tokyo has been the most important

machinery market in Asia during recent years. Formerly Calcutta and Bombay were of much greater importance and may soon be so again, but in view of the large share of the Japanese trade now being placed in the United States, Tokyo is probably more interesting to American manufacturers than any other city in Asia.

In order to appreciate the distances involved when one does business in Japan the following table is submitted:

From Tokyo to—	Miles.	Hours by rail.	From Tokyo to—	Miles.	Hours by rail.
Aomori	470	12	Nagasaki	881	37
Hakodate	530	17	Tsuruga	315	17
Yokohama	18	1	Fusan	828	39
Nagoya	234	9	Seoul	856	41
Kyoto	329	12	Antung	887	65
Osaka	356	13	Mukden	1,058	74
Kobe	376	14	Tientsin	1,495	94
Shimonoseki	706	27			

In other words, from Tokyo to Mukden is a distance similar to that from New York to St. Louis, but, as measured in time, largely because of the steamer trip across the Japan Sea of 122 miles, it requires as much time as a trip from New York to Salt Lake City.

In Tokyo there are a large number of firms of many nationalities that act as machinery dealers. Most of these are Japanese, but there are also a number that are American, an equal or larger number that are British, and several other nationalities are represented. The more important of these companies maintain well-equipped engineering departments with qualified sales engineers, and it is possible to buy practically any kind of machinery from any country and in so doing have the best of sales service. In normal times the market is active and competition keen, the buyers intelligent and alert, the sellers on the "qui vive."

Practically all imported machinery is marketed through these dealers; they are usually import merchants, and many have corresponding export offices in the United States. When an American manufacturer establishes a definite sales plan for this territory, it usually results in arranging an exclusive agency agreement with one of these dealers, and these agreements are entered into by even the largest and most important American machinery manufacturers.

Although it is not many decades since Tokyo was all but exclusively an oriental city of the old type, it has changed a good deal and the indications are that it will be greatly altered and in a few more decades will become practically an occidental city. It now has most of the usual conveniences in at least a part of the city. The machinery dealers generally have large and comfortable offices.

Up to the time of the Russo-Japanese war Japan was not an expensive place in which to live, but costs have been rising rapidly for a number of years and the point has now been reached where the European finds Tokyo perhaps the most expensive city in the world and the Japanese find that their style of life is also very costly. The day of cheap labor and cheap rents has gone, and as the conveniences for transportation, telephones, etc., are not up to the usual American standard, incidental expenses are very high.

The ricksha puller who worked well for 15 yen per month as recently as 1910 now gives indifferent service for 100 yen per month, and expects to be furnished livery and other incidentals besides.

The city of Tokyo is located at the head of a bay, and the water is so shallow that ocean-going vessels are unable to reach the city. For this reason all cargo is landed at Yokohama, and the import merchants find it necessary to maintain an office (or to make similar arrangements) at Yokohama as well as at Tokyo, in order to take delivery of their shipments. The resulting organization is frequently somewhat elaborate, and it often develops that the American business man lives in Yokohama and spends part of his day there, although he conducts most of his business in his Tokyo office.

In the Osaka-Kobe-Kyoto district the machinery trade is not so centralized, but most of the firms that maintain offices in this section have them in the older part of Kobe that has recently been rebuilt to a very large extent. Most of these offices are branches of firms in Tokyo, but some are independent. Usually the territory is divided near Nagoya, and sales engineers here travel over the southern part of Japan.

THE INDUSTRIAL TRANSITION.

To a very large extent the commercial history of Japan during the last four decades has been that of a transition from feudalism to modern industrialism. On emerging from a life of isolation Japan was out of touch with conditions then existing, but so vigorously has the nation assumed its position that in comparatively few years it has become one of the more important countries of the world.

There is a great resemblance between the situation of Japan in Asia and that of the United Kingdom in Europe. Each is an island empire lying off the continental mainland, and the following table suggests the similarity of their condition:

Items.	Japan.	United Kingdom.
Area in square miles	148,756	121,438
Population	55,961,140	46,089,000
Population per square mile	376	380

As the standard of living in Japan rises to equal that of the United Kingdom, it will be just as necessary for the country to import its food and export manufactured goods in payment. If it does not produce, it can not buy. As Japanese foreign investments multiply, Tokyo, like London, will become a banking center and can balance with gold the excess of imports. Without this gold, these manufactured goods, and the other usual assets, there can be no such excess of imports as is absorbed regularly by the United Kingdom. The Japanese are a very ambitious people, eager to raise their standard of living, and their progress is obvious to all who have known the country. The Japan that the writer left in 1911 had developed greatly as compared with the Japan he first saw in 1904, and the Japan he found in 1919 was changed from that of

1911. This phenomenal development is suggested by the following table:[2]

Years.	Total value of foreign trade.	Total number of factories.	Total number of workmen.	Mechanical industries.	
				Number of factories.	Number of workmen.
	Yen.				
1893	177,000,000	3,548	....	165	....
1894	230,000,000	5,971	....	327	....
1895	265,000,000	7,141	....	310	....
1896	389,000,000	7,580	420,000	340	1,000
1897	382,000,000	7,192	415,000	355	17,000
1898	443,000,000	6,945	386,000	416	23,000
1899	435,000,000	6,597	397,000	338	23,000
1900	491,000,000	7,188	394,000	430	31,000
1901	508,000,000	7,257	410,000	426	31,000
1902	530,000,000	7,751	490,000	436	34,000
1903	606,000,000	8,180	472,000	873	34,000
1904	690,000,000	9,164	517,000	560	45,000
1905	810,000,000	9,681	578,000	615	49,000
1906	842,000,000	10,261	605,000	686	58,000
1907	926,000,000	10,854	626,000	826	62,000
1908	814,000,000	11,304	741,000	828	54,000
1909	807,000,000	11,228	800,000	....	63,000
1910	922,000,000	13,381	700,000	972	55,000
1911	931,000,000	14,228	794,000	1,059	71,000
1912	1,145,000,000	15,119	863,000	1,260	89,000
1913	1,361,000,000	15,811	845,000	2,392	93,000
1914	1,186,000,000	17,062	853,000	1,401	87,000
1915	1,240,000,000	16,809	910,000	1,426	105,000
1916	1,883,000,000	19,299	1,095,000	1,857	149,000
1917	2,638,000,000	20,966	1,281,000	2,473	180,000
1918	3,630,000,000	22,391	1,409,000	3,117	222,000
1919	4,272,000,000	23,834	1,612,000	....	....
1920	4,285,000,000	....	....	....	....
1921	2,867,000,000	....	....	....	....

In seeking ways and means whereby it might improve its position it is not surprising that Japan has imitated the United Kingdom and given great attention to shipbuilding, shipping, cotton spinning, and the like, and in so doing has advanced to where it is third among the shipbuilding nations, fourth in the tonnage of its merchant marine, and sixth in the number of spindles in its cotton mills. Japan has also made great progress in many other directions as well, but they are far too numerous to mention here.

On the other hand, Japan will find it difficult to follow the British example in many ways. When the era of steam dawned upon the world the United Kingdom was one of the wealthiest of nations and has been a creditor nation ever since. Japan has been a debtor nation and even if, as some say, it is now a creditor nation, its margin in this direction is very narrow. The United Kingdom has excellent coal, produces about 300,000,000 tons per year, and has a reserve adequate for at least 700 years at the present rate of consumption. Most coal in Japan is of unsatisfactory quality. The country produces about 30,000,000 tons per year, and its reserves are apparently sufficient for 300 years at the present rate, but would last only 30 years if worked at the rate prevailing in the United Kingdom. Great Britain produces perhaps 10,000,000 tons of steel per annum at competitive prices. Japan has found it very difficult to produce steel satisfactorily and usually imports a very large part of its requirements.

[2] This table is from an article by Mr. Okamoto, Director of the Bureau of Commerce and Industry, that appeared in the Chugai Shogyo of Jan. 6, 1919, to which have been added such subsequent data as have become available. There is reason to believe that it is substantially correct.

To succeed as an industrial nation Japan must export, and in other parts of this report it has been shown that, particularly in the textile trade of China, Japan has been most successful. But costs are rising. In 1890 men in the cotton mills were paid from 9 to 12 sen (4½ to 6 cents) and women 6½ sen (3¼ cents) for a 12-hour day. By 1919 female labor received from 1 to 1.50 yen per day and male labor even more. The following tables of index numbers were prepared by the Japan Cotton Spinners' Association:

Years.	Male.	Female.	Years.	Male.	Female.
1903	67	64	1912	96	95
1904	69	64	1913	100	100
1905	71	66	1914	101	100
1906	75	71	1915	102	100
1907	81	77	1916	103	104
1908	84	78	1917	112	116
1909	88	83	1918	141	149
1910	90	85	1919	184	207
1911	93	90			

In presenting the above statements it is recognized that a great deal depends upon the interpretation put upon these figures, and it is also recognized that the subject is a little controversial, but it is obvious that costs in Japan have risen very rapidly and the labor problem has become far more difficult than it was, as is illustrated by the following table extracted from a speech made before the lower house of the Diet in February, 1919, by Mr. Tokonami, who was then Home Minister:

Years.	Number of strikes.	Number of employees involved.
1914	50	7,905
1915	64	7,852
1916	108	8,413
1917	398	57,309
1918	417	66,457

From the above it is apparent that Japan, since 1858, has been transformed from an oriental, feudal country and has taken on much that represents twentieth century occidental life. In doing this it has become more of a commercial, seafaring, and industrial country. As this transition has progressed, the cost of living has risen rapidly and is no longer cheap. Also, as the factory system has developed labor problems have also arisen, and the indications suggest that they will multiply. The evolution of the Japanese in recent decades has been rapid, and the process is continuing at possibly an even quicker pace. The development of the country creates a great increase in the demand for machinery, but although there is a strong disposition to protect the local manufacturers of such equipment there are many reasons why production of this kind is not entirely satisfactory.

MANUFACTURE OF MACHINERY IN JAPAN.

As "the Britain of the Orient" Japan has become a successful shipbuilder and manufacturer, and the operations of its railways, electric plants, cotton mills, and an endless number of other indus-

tries has created a very large demand for machinery. It has been inevitable that Japan should develop an ambition to manufacture this equipment. Efforts have been made in this direction, but the obstacles are very great.

To produce machinery on a competitive basis it is necessary to have iron and steel of many kinds at commercial prices. Decades ago it was known that Japan contains a great deal of iron ore and coal, and it was felt that in time it would be an important producer, but it has been found that most of the coal is unsuitable and when the ore has been used the product has been costly. Following this, efforts have been made to produce steel in Japanese plants in China, Manchuria, and Korea. There is reason to believe that these operations have also failed to produce satisfactory steel at a satisfactory price. This situation has delayed the development of the machinery-building industry in Japan, as the imported materials are costly, the domestic article appears to cost more than competitive goods, the import duty is sometimes an important handicap, and it is scarcely possible to maintain a satisfactory stock of the many kinds of steel and iron required by a modern machinery-building industry.

This matter is of such importance that a special commission investigated it in about 1916, and the following tables give the consumption of iron and steel in apan as reported by the above commission and published in the Japan Year Book for 1920–21, page 561:

	Pig iron.	Steel.
	Tons.	*Tons.*
1906–1910, average	124,007	472,487
1911–1915, average	200,228	691,884
1918, estimated	360,900	1,113,000
1919, estimated	743,000	2,112,000

These figures exclude imported cranes, machinery, etc. In considering the above volume it should be remembered that in 1919 the United States produced 31,015,364 tons of pig iron and 34,671,232 tons of steel, so Japanese consumption was less than 2½ per cent of that of the United States and less than 10 per cent of that of Great Britain or Germany or France, each of which has a capacity of about one-third of the American production. A great deal has been said at different times about the production of machinery by the Japanese; these figures suggest that it is not a "menace" and can scarcely become one.

A corresponding statement covering production reduced to a pig-iron basis and including all sources under Japanese control has been issued by the above commission and is as follows:

Years.	Japan proper.	Korea.	Manchuria.	China.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1915	345,600	....	30,000	200,000	575,000
1916	491,000	....	35,000	200,000	726,000
1917	539,900	....	70,000	200,000	809,900
1918	541,600	100,000	230,000	480,000	1,351,500
1919–20	541,500	100,000	230,000	480,000	1,351,500
1921–22	611,500	100,000	230,000	480,000	1,421,500

From the above it is clear that up to 1917 Japan imported a great deal of iron and steel. There is reason to believe that the large increase planned from Manchuria and China for 1918 has not been fully realized. Imports of iron and steel as reported by the Japan Year Book for 1918 were 268,897,000 yen, and for 1919 were 213,622,000 yen. It is often reported that the Imperial Government Steel Works operates at a great loss, and it is also reported that the Japanese consume ore that is produced in Korea, Manchuria, China, and even the Philippines. These reports lead one to conclude that the steel problem of Japan has not yet been solved satisfactorily.

On the other hand, the Japanese do produce an important amount of machinery, even if it is sometimes made from imported materials. The growth of the "mechanical industries" as measured by the number of employees has been shown on page 297. As far back as 1910 Japan could produce a 10,000-horsepower steam turbine and, it was reported, an electric generator to correspond. It was also stated that it could produce a 12-inch naval rifle. For many years and in several different shops the Japanese have produced a great variety of electrical equipment. Evidence is also available showing that some very accurate workmanship is possible.

The advertising in the technical papers in Japan shows that the shops there are prepared to produce electric motors, generators, fans, transformers, etc., the usual types of machine tools, internal-combustion and steam engines, printing presses, pumps, hydraulic presses, tank and boiler shop products, etc., and a visit to the salesrooms in Tokyo reveals many of these machines on view. Much of this equipment is made from imported materials, as for example the laminations in the magnets of electric motors. Early in the war it was unusual to import such a motor, but, when the embargoes shut off the supplies of this steel, importation developed at once.

Japan has even gone beyond supplying the local market for some of these products and has done an export business. The nature and volume of this export trade is indicated in the following from the returns of the Japanese customs:

Classes.	1917	1918	1919	1920	1921
	Yen.	*Yen.*	*Yen.*	*Yen.*	*Yen.*
Electrical machinery	2,493,000	3,984,000	4,443,000	5,211,000	3,034,000
Textile machinery	1,623,000	3,594,000	3,392,000	3,388,000	4,431,000
Lathes	644,000	1,006,000	445,000	583,000	389,000
Printing machinery	177,000	281,000	273,000	430,000	427,000
Other machinery	3,825,000	6,508,000	7,536,000	6,453,000	4,157,000
Total	8,762,000	15,373,000	16,089,000	16,065,000	12,488,000

In connection with these figures it should be remembered that textile machinery produced in Japan is seldom of a type to compete with American mill equipment, and the electrical classification probably includes items that the American customs would class as supplies.

But, despite the above-described production, it is recognized that the Japanese machine-building industry is not on a satisfactory footing. During the war unusual opportunities appeared and an ab-

normal production and exportation resulted. There is reason to believe that both have since fallen off. Some of the statistics in this report show that there is a tendency for these exports to disappear, as for example in the returns of the Netherlands East Indies. Also, complaint is sometimes made in Japan that even after an industry has been established and full investigation made in all foreign countries the Japanese industry again falls behind because it can not keep pace with progress in other countries. And, after all, this is most natural. There are very few industries in Japan that show a production in excess of 5 per cent of the corresponding American industry. Such Japanese enterprises operate in a territory of most limited resources, with labor and superintendence unaccustomed to factories, and with limited facilities for research and scientific assistance. World trade in general contracted a great deal after 1920, and it was to be expected that exports of machinery from Japan would fade. It mav also be added that at all times the quality and price of Japanese machinery has been unsatisfactory in Japan and also in the other countries where it has been used. In his article mentioned above Mr. Okamoto gives the following causes for the slow development of the mechanical industry of Japan:

1. Shortage and high price of raw materials.
2. Small demand.
3. No progress in the division of labor.
4. Difficulty in controlling factories.
5. Inadequate educational system for workmen.
6. Lack of banks engaged in trust-company business.
7. Lack of organizing ability.

For the better class of machinery and engineering ability in general, Japan will find it necessary to rely upon foreign sources of supply for a long time to come. The country may attempt to produce certain lines of equipment, but only rarely do they satisfy. The shops in Japan are restricted seriously in the selection of materials; their engineers ordinarily have had only limited experience; there is a great temptation to sacrifice quality to price; when designs are copied the original manufacturer's experience is absent, when "improvements" are adopted they are often of questionable merit. The American manufacturer will do well to disregard such "competition."

FUEL.

The fuel problem of Japan is very serious, as may be shown concisely in the following table:

Items.	United States.	Japan.	United Kingdom.
Population	105,683,108	55,961,140	46,089,000
Coal production per year . . . tons	500,000,000 to [1]600,000,000	25,000,000 to 30,000,000	275,000,000 to 325,000,000
Coal reserves unmined . . . do	2,171,153,000,000	9,000,000,000	209,000,000,000
Per capita consumption . . . do	5	0.5	6.5

[1] Was 605,546,343 long tons in 1918.

A statement of this kind is not adequate, for Japan has further sources of supply in Formosa, Korea, Manchuria, Sakhalin, and China, but even with these the supplies are disproportionately small.

Although the present coal reserves of Japan indicate a supply that is adequate for 300 years, as has been shown, this would dwindle to 30 years if production reached the quantity now mined in the United Kingdom.

Quality is also a most important consideration. Some Japanese coal is a good lump quality, but much of this coal is so friable that it is practically dust or low-grade screenings when delivered. It is very high in volatile matter and runs up to 20 per cent ash. The amount of coking coal suitable for the production of steel is very small.

The following table, derived from official publications of the Japanese Government, shows the situation in greater detail, and it is interesting to compare the rate of increase in production with the extent of the known reserves:

Year.	Number of miners.	Production.	Import.	Total supply.	Consumption.[1]		Export.	Total observed demand.
					Quantity.	Index number.		
		Metric tons.	*Metric tons.*	*Metric tons.*	*Metric tons.*		*Metric tons.*	*Metric tons.*
1909......	152,515	15,048,113	115,948	15,164,061	10,129,821	142.4	2,890,493	13,020,314
1910......	137,467	15,681,324	174,611	15,855,935	10,592,816	148.9	2,816,047	13,408,863
1911......	145,412	17,632,710	182,814	17,815,524	12,070,903	169.7	3,065,678	15,136,581
1912......	152,429	19,639,755	308,329	19,948,084	13,487,907	189.6	3,467,870	16,955,777
1913......	172,446	21,315,962	576,772	21,892,734	14,924,437	209.8	3,870,600	18,795,037
1914......	182,637	22,293,419	957,709	23,251,128	16,219,537	228.0	3,583,806	19,806,343
1915......	193,142	20,490,747	614,677	21,105,424	16,259,978	228.6	2,924,092	19,184,070
1916......	197,907	22,901,580	556,110	23,457,690	18,579,126	261.2	3,016,947	21,586,073
1917......	250,144	26,361,420	713,080	27,074,500	20,707,452	291.1	2,813,462	23,520,914
1918......	287,159	28,029,425	767,792	28,797,217	23,025,803	323.7	2,197,037	25,222,840
1919......	348,240	31,271,093	699,646	31,970,739	24,800,968	348.6	2,000,697	26,801,665

[1] Consumption, as given above, includes only shipping, railway, and industrial demand. Domestic and incidental consumption is excluded.

The above index number is based on the consumption of 1905, when the corresponding total was 7,113,900 metric tons, so in 14 years the consumption has been multiplied 3.486 times. In the United States the production in 1905 was 350,645,210 and in 1919 it was 487,638,572, so the increase in this country during the same period was proportionately much less, but in quantity was more than we can expect Japan to achieve, as the Japanese reserves can not support such development.

The increase in the demand for coal for shipping does not keep pace with the other forms. Corresponding to the above index number, the following shows in greater detail the nature of the expanding demand:

Use.	1905		1919	
	Tons.	Index number.	Tons.	Index number.
Shipping..	1,997,069	100	5,844,037	292.6
Railways..	841,591	100	3,273,192	388.9
Factories..	3,776,378	100	14,819,281	392.4
Salt production..	498,862	100	864,458	173.3
Total..	7,113,900	100	24,800,968	348.6

It will also be noted that while in the bituminous coal fields of the United States the coal mined per man per day is about 3.75 tons and per man per year about 850, in Japan the production per man per day is a scant half ton and per man per year between 80 and 125 tons, with a distinct tendency toward the lower figures in the more recent years.

These conditions would all lead one to expect an increase in prices, and this has been most pronounced in recent years. Definite data of a satisfactory nature are hard to obtain because of differences in quality, grade, and location. The official price of coal as published by the Japanese Department of Agriculture and Commerce[3] is as follows:

	Yen per metric ton.		Yen per metric ton.
1900	6.35	1913	8.01
1905	8.00	1914	8.35
1906	8.43	1915	7.83
1907	7.70	1916	9.04
1908	7.95	1917	16.08
1912	7.62	1919	[4] 32.78

The above increases do not indicate the situation as it was found in Japan in 1920, and it may be that these official figures are conservative. The following unofficial figures were secured while the writer was in Japan and represent the variations in the average price of bunker coal at Moji:

	Yen.		Yen.
1915:		1918:	
First half	5.50 to 6.00	First half	18.00 to 19.00
Second half	6.50 to 7.00	Second half	19.00 to 24.00
1916:		1919:	
First half	8.00 to 8.50	First half	24.00 to 26.00
Second half	8.50 to 10.00	Second half	26.00 to 27.00
1917:			
First half	10.00 to 12.00		
Second half	12.00 to 18.00		

In a report dated March 18, 1920, H. T. Goodier, vice consul at Yokohama, reported that the average 1913 price for first lump coal per long ton at dealers was 7.50 yen, in 1916 it was 10 yen, in 1918 22 yen, and in March, 1920, 35 yen. It will be noted that this was 16 months after the armistice.

The effect of a situation of this kind on points like Hongkong and Manila that formerly imported much Japanese coal is obviously most serious and is enough to make most boiler-room equipment obsolete. Until such time as other coal fields are developed or fuel prices reduced, industries in Japan or elsewhere that rely upon Japan for fuel will be handicapped to this extent. It would be difficult to find territory where fuel economy is more important.

It is estimated that about 75 per cent of the coal reserves of Japan are in Kyushiu, the most southerly of the larger islands, and 10 per cent in Hokkaido, the most northerly of these islands. In spite of this relation there is a tendency toward decrease in production in Kyushiu. This does not represent exhaustion or unprofitableness, but there are labor complications in this district which seem to grow more involved from year to year. It is not so much a problem

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[3] From p. 193, 34th Statistical Report.
[4] Average in Tokyo, as from Japan Year Book.

of wages or organization of labor as one of obtaining workmen for an unattractive employment.

In connection with some of the other countries reported in this monograph, the consumption of coal has been suggested as a measure of the demand for boiler-room equipment and indirectly as a measure of the demand for other kinds of machinery. In the present instance the same suggestion is useful, and, in addition, by use of the figures on page 302, one can revise somewhat these other estimates, as this information makes it possible to separate the industrial fuel consumption from that of the railways and other types of demand.

Petroleum is produced in Japan, but the quantity is insufficient and imports are heavy.

WATER POWER.

With fuel conditions as described, in a country with such great need for industrial development, interest in water power is obvious. Add to this the mountainous nature of practically all the islands and the abundant rainfall, and it is obvious that development is to be expected. Over the whole country the rainfall averages about 62 inches, or double that of Chicago. There are some districts with double this average rainfall. Water has been used for power purposes in Japan for a very long time—probably centuries. The first plant on modern lines was installed in Kyoto before 1900. By 1907 there were 38,622 kilowatts of hydroelectric equipment in operation. In 1917 this had become 511,090, and the rate of increase was extremely rapid. The detailed statements of the customs returns presented on page 323 will give further particulars regarding the machinery imported for this purpose. Accurate statistics for more recent years are not yet available, but in 1920 it was estimated that Japan could economically develop a total of 7,000,000 horsepower at its various water power sites, and of this more than 1,000,000 were in operation. In the interval between January 1, 1920, and June 30, 1921, it was reported that 260,000 horsepower of hydroelectric equipment had been ordered from abroad and 150,000 horsepower more ordered from builders in Japan. It was further anticipated that an additional 250,000 horsepower of such equipment was to be ordered in 1921. It is realized that these are very big figures.

THE ELECTRICAL SITUATION.

At the turn of the century in 1900 Japan had not installed very much electrical machinery. The first water-power plant mentioned above impressed the writer very much, because governors were not used. Regulation was manual, the operator being guided by a voltmeter. Evidently the engineer on this design computed that the depreciation and interest on a governor would exceed the wages of a man. Consequently an irksome task was started and indifferent regulation secured. About 1908, in a certain steam plant in Kyushiu, the high-pressure cylinder of a high-speed tandem compound engine was held in place with a jackscrew. But those days are gone forever. Japan has some very good power plants. A full report on the market for electrical goods in Japan was published

in 1918,[5] and the subject will not be carried into detail here. The general progress of the industry is shown in the following table:

Years.	Number of plants.			Capacity in kilowatts.		
	Water power.	Steam or gas power.	Total.	Water power.	Steam or gas power.	Total.
1903	79	377	456	13,124	31,128	44,252
1904	88	385	473	16,409	42,563	58,972
1905	98	413	511	18,547	55,827	74,374
1906	105	454	559	25,195	66,101	91,296
1907	132	470	602	38,622	76,288	114,910
1908	162	528	690	60,121	94,611	154,732
1909	195	574	769	73,507	108,709	182,216
1910	255	661	916	112,932	144,605	257,537
1911	341	812	1,153	143,831	177,733	321,564
1912	391	979	1,370	233,339	228,864	462,203
1913	510	1,099	1,609	321,596	275,260	596,856
1914	695	1,245	1,940	416,586	299,383	715,969
1915	943	1,297	2,240	449,220	322,364	771,584
1916	1,195	1,422	2,617	469,634	335,655	805,289
1917	....	....	2,891	511,090	364,473	875,563
1918	....	....	[1] 3,140	....	....	[1] 983,938

[1] The plants under construction in 1918 totaled 310, with a capacity of 837,968 kilowatts.

This development of electric central-station business is also shown by the following table, which indicates the growth of the power and lighting load (excluding isolated plants) during the same period and provides an index of the demand for motors, lamps, and accessories; the figures are from the Statistical Report of Electric Undertakings in Japan, issued by the Department of Communications:

Years.	Number of lamps.	Corresponding generator capacity.	Number of motors.	Total rated horsepower.
1903	365,090	16,008	563	4,107
1904	423,120	17,118	634	5,404
1905	510,341	19,955	966	5,446
1906	651,284	25,452	1,484	8,278
1907	859,143	33,265	2,385	11,249
1908	1,230,876	46,265	3,975	17,093
1909	1,611,604	56,551	5,820	23,111
1910	2,141,810	75,578	7,970	32,089
1911	3,096,516	99,897	11,248	44,055
1912	4,499,627	131,340	18,092	68,519
1913	6,148,420	160,865	27,376	107,273
1914	7,706,962	177,940	35,309	148,702
1915	8,420,357	190,396	42,789	182,704
1916	9,975,554	200,400	54,064	[1] 235,470

[1] The total horsepower of electric motors supplied from isolated plants at this time was 389,816, for 15,141 motors.

Just as the United States has developed a "Superpower scheme" for linking up all the electric-power circuits between Washington and Boston and another to cover the territory between Pittsburgh and Chicago, and as England and France and Italy have similar plans, so Japan shows a drift toward the linking up of power lines in certain districts. This has manifested itself in many ways. In 1920 and 1921 there were a number of cases in which various electric com-

[5] Electrical Goods in China, Japan, and Vladivostok, Special Agents Series No. 172; sold by Superintendent of Documents, Government Printing Office, Washington, D. C.; price 30 cents.

panies amalgamated. In addition it has been said that certain officials favor bringing all the power stations of Japan under one management. Between these extremes is a movement for a 100,000,000 yen concern to absorb the three leading companies in central Japan, another to cover important sections of Hokkaido, a similar project for Kyushiu, and in Formosa one or more water-power projects that would apparently electrify the whole island (about the area of Maryland) from a large lake in the south-central part of the island. One of the Formosan projects is expected to develop 190,000 horsepower; the second project is reported to be of corresponding though probably somewhat smaller magnitude. One is tempted to conclude that Formosa can not now employ so much power.

It may be that these superpower schemes in all the above-mentioned countries will develop slowly. It may be that these proposals are premature, but when Japan places actual orders for 410,000 horsepower of water-power equipment in 18 months, as indicated, one seems justified in thinking that these ventures are more real than fantastic. The point has been reached where, out of about 10,000 cities, villages, and towns in Japan proper, about 70 per cent are supplied with electricity and the per capita consumption is 47 kilowatts per year.

MANUFACTURE OF ELECTRICAL MACHINERY.

Conditions as described have encouraged the production of electrical apparatus and machinery in Japan, as indicated on previous pages, where the emphasis was placed upon iron and steel, but the subject is of sufficient importance to justify additional comment in connection with the subject of copper. This metal is found very commonly in Japan and has been produced since very ancient times. Among the mineral products of the country it ranks next to coal in importance. The value and volume of the production has been as follows:

Years.	Weight.	Value.	Price per pound.
	Pounds.	*Yen.*	*Sen.*
1908	80, 339, 848	22, 409, 424	28
1909	101, 869, 525	24, 536, 150	24
1910	109, 608, 544	25, 819, 259	24
1911	118, 670, 320	27, 133, 448	23
1912	138, 716, 665	40, 252, 061	29
1913	147, 780, 544	42, 012, 126	28
1914	156, 585, 441	39, 067, 387	25
1915	167, 590, 309	53, 731, 798	32
1916	223, 634, 492	109, 812, 610	49
1917	240, 085, 000	118, 692, 244	49
1918	200, 758, 428	90, 390, 232	45
1919	174, 318, 481	67, 581, 475	39
1920	150, 649, 000	....	....

Under the conditions existing up to 1919 Japan exported copper heavily, as follows:

	Yen.
1911	20, 002, 000
1912	24, 284, 000
1913	28, 183, 000
1918	37, 749, 000
1919	19, 647, 000

But when the price fell, as it did in 1919, Japan became an importer and absorbed about 40 per cent of the American exports of that year, the record now being:

Years.	Ingots and slabs.	
	From Japan to United States.[1]	From United States to Japan.[2]
	Pounds.	*Pounds.*
1914	10,615,577	[3] 152,212
1915	17,685,945	
1916	6,593,349	....
1917	160,429,600	[3] 16,778
1918	71,252,933	33,075
1919	43,208,400	65,595,603
1920		82,913,730
1921	....	59,170,325

[1] From Japanese returns.
[2] From United States returns.
[3] Fiscal years.

Evidently the cost of labor and supplies has been rising in recent years to a point where the copper mines of Japan feel the pinch of American competition. Increasing imports with decreasing production can scarcely be interpreted otherwise. For a good many years Japan has been producing wire, switches, and more elaborate apparatus and has exported a certain amount of such equipment to the other countries of Asia. Under the protection of its tariff it is probable that Japan can continue to manufacture for its own market, but with copper cheaper in America than in Japan it would seem that the Japanese export trade in this line would be in danger if the buyers gave proper consideration to the quality of their purchases. In considering the question as to the price at which Japan starts to import copper, reliance should not be placed on the figures on page 306. These are merely the statistical returns of the Japanese Government. This critical value will vary from day to day, and with falling freight rates it will be increasingly easy to export copper to Japan. When this export movement started in 1919 the American price was approximately 16 to 18 cents per pound. The growth of the electrical industry of Japan will create a great demand for such materials.

COTTON-SPINNING INDUSTRY.

In the section of this report that refers to India, comparative figures relating to Japan have been presented (p. 101), and it will not be necessary to repeat here what has previously been recorded. This industry was first started in Japan in 1862 and is probably the oldest of the modern industries there. By 1889 Osaka and neighborhood had 115,000 spindles. In December, 1920, the spindles in Japan were reported at 3,813,580 (excluding 466,460 doublers). The industry has been very successful in both the domestic and the export business, and, as has been shown elsewhere in this report, the Japanese now have an overwhelming participation in the textile trade of China.

Under a protective tariff Japan will obviously arrange to supply its own demands, and if the efforts to grow cotton in Korea are successful, it may even escape the need of importing the raw material. The export business and the influence of the Japanese on the trade in China depends in part at least upon the hours the employees work in the mills. Until recently the mills in Japan ordinarily ran 22 hours per day, using two shifts of 11 hours each. The mills in India have not operated in this way, and it has been reported that this difference in time has forced the mills of India out of the China market, but this statement can probably be challenged by use of the Hongkong statistics. But, regardless of the merits of this controversy, the matter of hours of employment was up at the Washington conference and the laws of several of the Asiatic countries have been modified to comply with those findings. If it is true that India has suffered in the China trade because of the hours of labor in Japan, it is probable that the situation will soon be righted by these changes, and under these circumstances there would be a tendency to discourage further mill extensions in Japan and correspondingly to increase the plant capacity in China. No such tendency has been noted. In India, China, and Japan there seems to be a desire to install additional mill capacity as rapidly as the necessary machinery can be secured, and it is anticipated that Japan will continue to add to its spindle and loom equipment. There will also be a tendency toward the production of finer yarns and cloths and some effort toward better dyeing and finishing. It is probably safe to say that many Japanese buyers have not purchased American textile-mill equipment because they did not appreciate its excellence. Salesmanship is needed to meet this situation. American designers have an opportunity to show the superiority of their designs in offering their equipment in Japan. In studying the opportunities of the Japan market, machinery manufacturers should also remember that Japanese interests own about 500,000 spindles in China.

At times efforts have been made to produce textile machinery in Japan, and it has been claimed that this has been managed successfully in one of the arsenals. At any rate it is known that the arsenal has not felt that it could continue such production, so the problem of producing such machinery still lies before the Japanese machine shop. This will not prove to be an easy problem, for the mill owner usually wants to place orders for 30,000 to 50,000 spindles at a time and this makes it all but impossible to undertake the necessary development work. The problem is that of starting production on a fairly large scale for prompt delivery without opportunity for experiment.

SHIPBUILDING.

In shipbuilding the Japanese have a most creditable record, and probably this industry illustrates as clearly as any the possibilities of the Japanese in industrial lines.

The Japanese are good seamen, and there is much to be said in favor of the junk as a cargo or fishing vessel. Also, there is a great deal of splendid carpentry in these boats, which have evidently been built in their present form for centuries, and the type has held its own throughout the 60 years since the country was opened.

The Japan Year Book for 1914 states that at the end of 1912 there were 228 shipyards in Japan proper. This total includes all of the little boat shops in the main archipelago. At the end of 1913 there were 6 shipyards capable of building the modern type of steamship and having 26,139 employees and 17 building berths. War stimulated building tremendously, and in March, 1918, the industry had expanded to 57 yards with 97,355 employees and 157 building berths; in December, 1919, this had fallen to 28 yards with 90 berths and 86,000 employees. Similarly, prices advanced sharply from about $55 per dead-weight ton in 1914 to $120 late in 1916, to $370 late in 1917, and to $405 early in 1918. Instances have been recorded where the price reached $500. Since the armistice prices have collapsed, but the above experience stimulated production remarkably, with the result that some astonishing speed records were secured.

It was stated verbally to the writer that the entire Asano yard, between Yokohama and Tokyo, was built and a 5,000-ton vessel launched in six months. To start a yard on an unimproved beach, put in foundations, buildings, machinery, acquire the materials, and launch such a vessel in half a year would tax any first-class organization operating under favorable circumstances, but add to this the obstacles involved by bringing practically all the machinery and a large part of the materials 10,000 miles and the achievement demonstrates splendid organizing ability.

On October 7, 1918, the Kawasaki Dockyard at Kobe laid the keel for the *Raifuku Maru*, 9,000 tons, dead weight, length 385 feet, beam 51 feet, molded depth 28 feet, speed on trial trip 17.39 knots. The vessel was launched October 30, being built in 23 days. This is claimed to be a world's record and is a most remarkable achievement.

The United States Shipping Board contracted in Japan for 45 steel cargo carriers as a war measure. The first group of contracts covered 15 vessels, ranging in size from 6,800 to 11,000 dead-weight tons and averaging 8,522 tons. The second series covered 30 vessels, totaling 246,300 tons. These two contracts involved about $37,500,000 and are among the largest shipbuilding contracts ever placed.

In 1896 a law was passed for the encouragement of shipbuilding. This was a form of subsidy that was effective. The *Hitachi Maru*, of 6,000 tons, built at the Mitsubishi yard at Nagasaki, was the first large steamer built in Japan. The above-mentioned law was modified in 1910. Up to March, 1913, the number of vessels built under these laws was 119, with a tonnage of 352,891. During the years 1915–1918, inclusive, Japan built 324 steel vessels that were larger than 1,000 tons and totaled 1,107,338 tons.

The launchings in Japanese yards have been:

Years.	Number of vessels.	Tonnage.
1918	377	626,000
1919	133	613,849
1920	145	448,000

The above-mentioned laws are reported to have lapsed in June, 1917.

Following 1919, conditions became difficult, as shipbuilding all over the world felt the end of war and postwar booms. By 1921 the yards in Japan had practically no private work and were dependent upon the Japanese Navy for orders.

The Japanese merchant marine in July, 1914, included 408 ships of over 1,000 tons, the total tonnage being 1,270,000. By December, 1920, it had developed to 750 vessels of 2,551,000 tons. Obviously this fleet will provide a good deal of employment for these yards.

In the above remarks no reference has been made to the navy yards, of which there are several. In the private and government yards Japan has produced a navy that ranks third among those of the world. Vessels in excess of 30,000 tons have been built both in the Kawasaki yard at Kobe and the Mitsubishi yard at Nagasaki. Provision was made for a class of 40,000-ton battleships, and a very elaborate program, including capital ships and auxiliary craft, with destroyers and submarines, was developed. As a consequence shipbuilding in Japan in 1919 and 1920 was probably as active as in any country in the world. The collapse of the demand for merchant types and the restriction of the naval program as a result of the Conference on Limitation of Armament at Washington may be expected to modify the situation.

In this connection it should be added that Japan does more than fabricate ships out of imported materials. The authorities claim that they are nearly independent of foreign sources of supply, stating that satisfactory armor is produced at the Imperial Steel Works and also at the Kure Navy Yard, guns are produced at Muroran, and steam turbines of adequate capacity, as well as electrical and other machinery, are produced at the Kawasaki and Mitsubishi yards as well as elsewhere. The development of the Japanese shipbuilding industry has been a marked achievement.

But there are grave complications in the situation. Shipbuilding in Japan is subsidized, and vessels built there of imported materials may prove to be inordinately costly. Also, there is reason to believe that steel produced in Japan is not competitive. So long as war prices prevailed, Japanese steel makers and shipbuilders could probably earn profits, but with the collapse in the prices for steel and tonnage this industry in Japan is faced with grave difficulties. It is quite possible that Japanese builders will find themselves unable to meet world prices under competitive conditions, and since (as has been shown) a substantial amount of the steel required has to be brought 5,000 miles or more to their yards, this is not surprising. In the past this situation was aggravated by the imposition of import duties on shipbuilding materials, but it has been proposed that these be remitted. The circumstances of the case have emphasized the labor cost of Japanese-built ships, and in recent years there have been some severe strikes.

CLOCKS AND WATCHES.

As the story of shipbuilding in Japan demonstrates the ability of the managers and workmen in certain directions and affords a measure of the capabilities of the people and the development of the country, so the clock and watch making industry illustrates another

class of work. In the early days of trade New England sent large quantities of clocks to the Orient. About 1887 the modern industry was started in Japan, and the production is indicated in the following table:

Years.	Number of employees.	Standing clocks.		Hanging clocks.		Watches.		Total value.
		Number.	Value.	Number.	Value.	Number.	Value.	
			Yen.		*Yen.*		*Yen.*	*Yen.*
1909	1,417	260,700	408,519	344,627	702,888	53,769	175,235	1,286,642
1910	1,508	292,171	478,933	381,514	860,635	54,136	198,507	1,538,075
1911	1,717	394,103	576,702	467,270	1,040,482	50,055	216,600	1,833,784
1912	1,711	391,810	574,691	477,583	964,880	60,849	252,261	1,791,832
1913	2,000	347,398	527,771	490,609	1,010,258	88,100	328,550	1,866,579
1914	1,999	324,209	498,907	398,618	771,828	101,600	678,500	1,649,235
1915	2,067	550,814	639,128	336,122	660,053	124,500	460,650	1,759,831
1916	2,248	680,809	892,026	195,815	591,202	134,212	499,594	1,982,822
1917	2,849	741,191	1,064,692	241,002	821,961	162,955	612,384	2,499,037
1918	3,631	728,394	1,430,876	278,948	1,444,856	211,718	1,074,736	3,950,468
1919	3,808	654,395	1,765,601	386,676	2,540,344	262,173	2,621,704	6,927,649

In 1917 there was 1 factory in Tokyo, 1 in Osaka, and 17 in the neighborhood of Nagoya. In 1919 there were 27 factories.

The above table demonstrates much that is of interest to the machinery manufacturer who wishes to gauge the possibilities of the Orient. This table represents a trade that has grown to nearly $3,500,000 per year. A large proportion of the clocks and watches are exported, the figures being:

Years.	Number.	Value.	Years.	Number.	Value.
		Yen.			*Yen.*
1909	251,576	554,263	1915	638,422	1,034,836
1910	283,033	625,697	1916	709,684	1,186,033
1911	293,516	621,438	1917	519,797	1,311,785
1912	326,697	713,864	1918	458,490	1,827,321
1913	473,706	993,419	1919	514,914	1,831,902
1914	383,877	804,068	1920	254,892	1,359,000

The above exports go to practically all the countries of the world, including even Switzerland. But it will be noted from the table above that the average employee produces about 1,800 yen's worth of merchandise, while before the war the figure was less than 1,000 yen. It will also be noted that the average value of a watch is less than 10 yen, and in some years less than 4 yen. Clocks work down to an average value of less than 2 yen. Even though these be manufacturers' average values as reported by the Japanese Government, they indicate the nature of the competition offered to American products—if "competition" be the word to use.

CHEMICALS.

Before a country can be considered to have attained a satisfactory stage of industrialization, an adequate chemical industry is necessary, and it is very difficult to establish this because of the interdependence of the various units. In the extreme case this is shown by the coal-tar series, which is said to number about 65,000 different products and requires a series of very large plants for adequate production. It would be extremely difficult for Japan to produce this immense series of products even if all conditions were favorable.

In the simple forms of chemical production Japan has made some substantial progress, but a great deal still remains to be done. The direction first taken was toward the natural products of Japan or articles of common need, as follows:

Camphor production.
Paper making.
Lacquer production and use.
Soap and candle making.
Coal gas with by-product recovery.
Brewing.
Sugar refining.
Explosives and munitions.
Salt.
Fertilizer.

Later other classes of production were started and the following articles produced:

Acetic acid.
Acetone.
Sulphate of alumina and alum.
Ammonium sulphate.
Carbonate of soda.
Caustic soda.
Celluloid.
Bleaching powder.
Hydrochloric acid.
Nitric acid.
Sulphuric acid.
Iodine.
Potassium chlorate.
Potassium chloride.
Sodium sulphate.
Wood alcohol.
Industrial alcohol.

If Japan is to become adequately industrialized this list must be extended very much. It is not claimed that it is complete, but there are many directions in which more development is required. The Japanese Government has given a great deal of attention to the matter of developing a comprehensive chemical industry in the country, but the problem is still for the future. If means are found this chemical industry should be expanded a great deal in the years to come, and much equipment will be needed for these purposes. The problem involves the development of sources of supply for the raw materials, the development of markets for the products, cost analysis to keep the different enterprises within commercial limitations, a proper development of the key industries before the establishment of the dependent units, and a proper coordination of the whole program. Each of these problems is intricate, and the changes in world conditions in recent years have introduced disturbances that endanger the most careful calculations. Japan, like each of the other countries of Asia, needs a chemical industry, but it will probably be a slow if not tedious task, and development of diversified production in commercial quantities will require time. Specific information regarding the different branches of the industry would go too much into detail for present purposes, but a study of the customs returns over a period of years provides some information of interest. For example, it is noted that imports of ammonium sulphate fell from 16,000,000 yen in 1913 to 2,100,000 yen in 1919, which suggests that the plants in Hokkaido and Kyushiu producing calcium cyanamid from atmospheric nitrogen were successful under war conditions.

In bacteriology and medical work certain Japanese scientists have risen to positions of distinction, and it is to be anticipated that in due season Japan will have an important chemical industry.

CEMENT.

As an industry the production of cement is important. Also, the consumption of cement provides a rough measure of the amount of engineering construction work done and, as this shows definite

development during a period of years, provides an index of the progress of the community in these lines. Cement manufacture was started in Japan in 1880, and, although progress was slow at first, production was stimulated by the Japan-China war of 1894–95 and again by the Russo-Japanese war of 1904–5. For many years a certain amount of Japanese-made cement has been exported mostly to near-by countries. The following table shows the production and consumption of cement in Japan:

Years.	Production.	Consumption.	Years.	Production.	Consumption.
	Barrels.	*Barrels.*		*Barrels.*	*Barrels.*
1908	1,794,695	....	1914	4,415,476	3,443,000
1909	2,331,361	....	1915	4,096,456	3,031,000
1910	2,638,709	....	1916	4,772,579	3,846,000
1911	3,125,148	....	1917	4,654,543	4,571,000
1912	3,821,279	3,101,000	1918	6,165,566	....
1913	4,562,237	3,397,000	1919	6,199,000	....

Up to 1917 the above production was divided among about 20 different factories owned by about a dozen companies. One additional company was organized in each of the years 1918, 1919, and 1920. Altogether the industry employs probably more than 50,000,000 yen. Also, there is a Japanese plant near Dairen in Manchuria, which can produce about 250,000 casks of cement per year.

In the earlier years the cement mills of Japan were often equipped with European machinery, and the plant designs left much to be desired. More recently the more important plants have been equipped with rotary kilns, often of American manufacture, and the crushing and grinding equipment is also commonly from the United States.

PAPER MILLS.

It is necessary to distinguish between handmade and factory-made paper in Japan. The former industry is very old, and some very high qualities are produced in this way; inferior grades are also produced. Despite the fact that this industry appears to be a strange survival of the old régime and destined to extinction in due course of time, it exhibits marked vitality even during a period of advancing labor costs. The situation is illustrated by the following figures for Japanese handmade paper:

Years.	Number of factories.[1]	Number of employees.	Wage index number.[2]	Total value in yen.
1909	55,617	161,135	....	18,218,548
1910	54,917	162,543	....	19,781,920
1911	55,412	167,897	....	20,330,306
1912	53,474	156,334	143.7	20,387,955
1913	52,319	153,549	150.0	20,935,391
1914	48,960	150,568	140.6	18,563,067
1915	47,232	145,394	140.6	22,395,698
1916	45,621	145,621	150.0	24,740,672
1917	45,861	147,448	171.9	36,283,552
1918	45,474	149,381	....	53,932,699
1919	45,025	154,400	....	79,574,079
1920	....	....	....	....
1921	....	....	....	....

[1] It will be noted that these average less than 4 employees each. Such plants seem curious at first, but it will be observed that as a whole the industry is important.

[2] Based on the year 1900 as a par.

Machine-made paper forms an altogether different industry that should not be confused with the above. The first paper mill of the modern type was established in 1872, and the industry has developed rapidly ever since. This industry is in competition with that in foreign countries and has reached a stage of development where it can meet the domestic demand and have a margin for export in the grades produced. There is also an import of perhaps 10 per cent of the mill production—but this introduces the question of grades. The recent development of this industry is shown below:

Years.	Number of mills.	Number of employees.	Paid-up capital.	Production, in pounds.			
				Printing.	Strawboard.	Cigarette paper.	Other.
			Yen.				
1909	27	6,486	20,811,345	127,113,350	66,534,516	10,003,486	43,943,276
1910	29	6,491	21,091,229	138,634,793	56,573,737	4,738,838	71,687,454
1911	34	7,841	21,117,317	181,650,015	65,667,676	2,091,432	56,699,134
1912	33	7,271	23,271,207	188,029,858	63,461,720	4,311,736	68,269,321
1913	35	7,622	23,748,473	230,323,517	70,602,001	4,812,293	69,017,238
1914	38	7,906	26,791,043	293,182,086	59,426,117	7,596,860	68,699,459
1915	44	9,032	28,471,076	292,924,197	110,047,254	8,869,558	86,667,904
1916	51	10,290	31,397,623	311,253,680	122,126,075	9,516,835	115,691,656
1917	55	11,424	26,364,500	305,717,535	136,206,006	12,163,477	160,170,507
1918	65	13,212	38,804,000	372,003,823	324,441,246	17,746,064	161,557,773
1919	72	13,627	41,208,500	355,938,876	171,257,187	11,655,645	183,698,355

The paper industry has naturally created a demand for pulp; much of this has been imported, but the need has been felt for pulp production in Japan. Production and importation have been as follows:

Years.	Production.	Import.
	Pounds.	*Pounds.*
1913	170,000,000	107,000,000
1916	302,000,000	129,000,000
1917	379,000,000	36,000,000
1918	463,000,000	64,000,000

Practically all this pulp is produced in Sakhalin (Karafuto), where it is reported that 15 companies have 24 pulp mills with a capacity of 922,000,000 pounds per year.

The point has apparently been reached where Japan can export pulp and a certain amount of paper of the grades that the country produces. It will still be necessary to import a certain quantity of paper of the finer grades and the chemicals, rosin, etc., that are needed. Some years ago an attempt was made to produce pulp from certain kinds of bamboo in Formosa. A complete plant was installed and operated for some time, but the project was subsequently abandoned. The particular difficulty was apparently the cost of transportation, as it was found expensive to deliver the bamboo to the mill. This is a matter of considerable interest, as there appear to be similar projects under consideration in many different parts of Asia.

American machinery is used in a very large number of the paper and pulp mills of Japan. The extent of this participation is indicated in the customs returns published on pages 328 and 330.

VEGETABLE-OIL INDUSTRY.

Like practically all the other Asiatic peoples, the Japanese have extracted vegetable oils for centuries. The waterproof paper used on Japanese umbrellas and lanterns is prepared in part from perilla oil; the elaborate headdress of the Japanese women is in part the result of treating the hair with the oil from camellia seeds; and, as this type of headdress and these lanterns and umbrellas were known centuries ago, this industry is correspondingly old. The hand-power mill of Japan is a primitive type of oil press that operates on the wedge or screw principle and resembles types found elsewhere in Asia. There are thousands of these mills in Japan, the returns of the Department of Agriculture and Commerce being as follows:

Years.	Number of oil factories.	Number of employees.	Years.	Number of oil factories.	Number of employees.
1908	10,585	15,495	1913	5,092	9,971
1909	7,352	13,065	1914	5,165	9,586
1910	6,972	12,590	1915	9,402	15,179
1911	6,779	12,036	1916	13,084	18,965
1912	5,610	10,419	1917	21,304	28,663

The above returns are somewhat confused because there are in Japan about 40 modern-type mills with hydraulic presses, absorption or similar equipment that are included in the above table. Of these 40 mills, 20 are in the neighborhood of Kobe and Osaka, 9 near Nagoya, and 7 near Yokohama, with some others scattered. The effectiveness of the modern type of mill is indicated by the following figures, from the Japanese Government returns for 1917:

Items.	All Japan.	Osaka-Kobe district.	Percentage in Osaka-Kobe district.
	Number.	*Number.*	
Factories	21,304	143	0.7
Employees	28,663	1,878	6.5
	Yen.	*Yen.*	
Production of all oils	[1] 38,150,328	14,834,522	38.9

[1] Money value is used, as quantities are not available.

This table shows that the modern mills in the Osaka-Kobe district, constituting less than 1 per cent of the "factories" and having about 6½ per cent of the labor, turned out in 1917 nearly 40 per cent of the product.

In other sections of this report it has been pointed out that the world market for vegetable oils has become particularly competitive and presumably will be influenced strongly by the fiscal arrangements of various European countries; extraction plants in Asia may find business difficult even when the raw materials are produced near by, as in India, the Philippines, the Netherlands East Indies, or China. Japan produces very small quantities of these products and imports practically all of its copra, soya beans, peanuts, cotton seed, etc. As the soya beans are produced largely in Manchuria and the

peanuts in Shantung, and as the trade routes to the Occident from these districts pass through Kobe, it will be observed that there is a certain justification for the extraction of the oils in Kobe, particularly so when it is also remembered that the cake is needed to fertilize the fields of Japan; but it does not seem quite natural for the United States to buy coconut oil from Japan, as the trees grow even south of Manila. In 1918 Japan imported 166,000,000 pounds of copra, valued at $7,817,000.

The war had a very great influence on the vegetable-oil industry of Japan. Up to 1914 the oils produced were principally those that had long been consumed in Japan, to which there had been added soya beans from Manchuria, cotton seed (somewhat related to the textile industry of Japan), rapeseed, sesame seed, and a little copra. The following table indicates the growth of the industry:

Years.	Oil production.	Wax production.	Years.	Oil production.	Wax production.
1913	[1] $7,393,614	$1,728,763	1916	$13,555,430	$2,488,528
1914	8,312,282	1,654,665	1917	19,075,164	2,808,958
1915	10,148,334	2,129,095	1918	27,051,220	4,095,845

[1] These figures are in United States dollars and, together with much of the other information here presented, are from the report of E. R. Dickover, of the American consulate in Kobe, revised somewhat to include more recent figures.

Under the Japanese law certain mills are allowed to import oilseeds and export the products without paying duty, adopting a method somewhat like the American practice of holding goods "in bond." This business grew to important size during the war, and, for statistical purposes, since such products are not considered Japanese produce, they are not included in the above figures. To include such "bonded" oils it would be necessary to add about $1,500,000 to the 1918 returns as indicated in the preceding table.

The machinery in the nearly 40 modern oil mills of Japan is of American, British, and Japanese manufacture. Japanese shops can produce a hydraulic press of fair quality, but, as is often the case, it will scarcely satisfy the intelligent buyer. So far American equipment seems to be the most satisfactory and represents the best engineering, and, in view of the keen competition now existing in the international market for vegetable oils, the best machinery will be needed in these plants.

Of the plants in Japan two have been equipped to extract the oil by a benzine absorption process. Superficially this process seems to be the more promising, as the costs for labor, power, etc., are lower and the by-product is discharged as a meal rather than as a cake, facilitating the preparation for use as a fertilizer. Actual experience indicates that the pressure system is the more satisfactory, as the above advantages are offset by the costliness of replacing the benzine losses, the higher class of labor required, and the fact that oil obtained by the absorption process is not so well received in the market.

REESTABLISHMENT OF JAPANESE INDUSTRY UNDER POST-WAR CONDITIONS.

The vegetable-oil industry illustrates a very difficult situation now confronting many of the enterprises of Japan, and that is the problem of overcoming the rapidly changing conditions of war and reconstruction. As has been illustrated in the case of the electrical industries, the changes of recent years have apparently left the cost of Japan copper above that of the world market and the Japanese industry must struggle with this new handicap. The vegetable-oil industry developed, very largely, under the abnormal conditions of 1914–1919 and must now face a buyer's market of exceptional severity. To a large extent its growth was stimulated by the scarcity of shipping, especially in European waters, but this scarcity exists no more. Similarly, with other industries, whether established before or after 1913, there has been a change in the levels of commodity values and an increase in the cost of labor and fuel that has disturbed the very fundamentals upon which many of the industries of Japan were established. In each instance the management is now confronted with the problem of meeting the new situation in order to survive.

GENERAL INDUSTRIAL SITUATION.

It is well known that Japan has developed its industries very rapidly, but the following figures may prove interesting. Japan opened its doors to the foreigner in 1858. Certain industries, such as paper, cotton spinning, etc., were started very early, as has been stated. By 1886 the report of the Department of Agriculture and Commerce showed that there were 311 steam engines in use in 217 factories having a total horsepower of 4,094. These engines were employed in part as follows: Silk filatures, 82; coal mines, 47; rice hulling, 44; shipbuilding, 16; cotton spinning, 13; printing, 6.

By 1917 Japan employed 5,797 steam engines with more than 250,000 horsepower capacity in something over 14,000 factories. In addition, it also employed 838 steam turbines of more than 210,000 horsepower, 1,713 gas engines of more than 36,000 horsepower, 528 oil engines of 4,100 horsepower, 247 water turbines of over 370,000 horsepower, and 102 Pelton wheels of 52,000 horsepower. The returns also show that 22,847 electric motors of 1,162,000 horsepower were in service. This latter figure may involve some duplication and raises the question of a load factor, but it may be said that the 4,094 horsepower of 1886 had risen to 882,000 horsepower in 1917 and by that time the consumption of coal for industrial purposes had risen to 8,239,117 tons per year. The way in which this power and fuel consumption was distributed in 1917 between the various industries is indicated in the table which follows.

Classification.	Number of factories.	Horsepower installed.						Coal consumed.
		Steam engines.	Steam turbines.	Gas engines.	Oil engines.	Water wheels.	Electric motors.	
								Tons.
Spinning	155	59,336	29,736	835	342	1.618	48,247	861,835
Weaving	2,794	23,032	4,331	11,235	714	2,976	91,666	510,423
Machine making	673	5,591	3,831	1,232	389	8	18,056	387,168
Ship and car building	155	12,659	10,034	3,056			52,067	296,008
Paper mills	226	16,926	2,362	3,555	77	41,707	45,840	524,071
Fertilizer	36	2,089	20	837	18		1,782	25,876
Breweries	564	4,295	330	310	248	134	3,151	163,437
Rice and flour mills	256	4,478	554	491	2	54	6,254	55,160
Woodworking	658	17,932	1,269	1,173	108	862	7,471	10,449
Electric plants	87	17,120	147,396	2,281	20	196,600	33,997	761,836
Gas works	35	1,672	1,528	1,980	634		1,917	331,569
Metal refineries	88	6,744	815	1,214	20	1,981	24,130	521,793

NOTE.—This table illustrates well the difficulty of working with Japanese statistics because of the point of view from which they are compiled. It will be noted from page 314 that there were in 1917 only 55 paper mills producing machine-made paper and from page 313 that the average handmade-paper plant has fewer than 4 employees, yet the above figures show 226 mills using power. The original from which the above is condensed shows 8 electric plants "not worked by motive power." It is difficult to conceive of a hand-power generating plant. It also shows 173 hand-power shipyards. Most of the breweries produce sake, a rice wine; there are only 7 or 8 beer breweries, and these would represent a large share of the above power consumption. No matter how much care is exercised it is impossible to avoid creating inaccurate impressions of the industries of Japan. These figures are submitted to show the relative importance of the different industries as measured by their power consumption.

Examination of an industrial directory of Japan shows 63 firms listed as machinery manufacturers. In this list are the names of some of the largest shipyards of Japan, that may employ as many as 20,000 men. The list also includes names of negligible consequence, including some who are not really manufacturers. For advertising and other business purposes the list is also unsatisfactory because it does not include the arsenals, dockyards, shops of the Government Railways, and a number of other shops that are among the most important in the country. This illustrates what has been stated elsewhere, namely, that it is impractical to attempt to cover the Japanese business field directly from the United States. To reach these buyers it is necessary to have representation in the country either directly, through a branch, or through one of the machinery dealers resident there.

COST OF MAINTAINING AN OFFICE IN JAPAN.

Since, as has been shown, Tokyo has been the most important market for American machinery in Asia and one of the most interesting in the world, it seems probable that a manufacturer would enter this market if any. The first problem is to decide whether to open a branch or arrange for an agency. The following figures are the result of inquiries made early in 1921.

The manager of an office in Tokyo finds it necessary to maintain a home with at least three servants (if with children, even more), rents and other expenses are very high, and the bare cost of living will be not less than 1,000 yen per month and will probably be more than 1,200 yen. (A man without any social responsibilities, such as the erecting superintendent of a factory, if married, can not live on less than 800 yen per month.) A case was reported where the manager of the Tokyo office of one of the largest American manu-

facturers, having a wife and two young children, resigned because he could not live on $10,000 per year. Tokyo is probably the most expensive city in the world for American business men of this class.

The rent of an office in a modern type of building costs from 10 to 25 yen per tsubo (4 square yards) per month. It is true that there are unheated Japanese-type buildings, having practically no conveniences, that can be secured for possibly 5 to 10 yen per tsubo per month. Storage space in a brick warehouse may be had for 8 yen per tsubo per month.

A good Japanese engineering salesman must be paid not less than 300 to 350 yen per month, which is now his bare living wage, to which should be added a commission on his sales, as is the custom of the country. An engineering student frequently starts his business career after graduation at 150 yen per month. A foreign stenographer costs from 250 to 350 yen per month; a mere typist, Japanese, 100 to 150 yen per month; a girl to carry messages, 30 to 40 yen per month; and an office boy, 15 yen per month as an absolute minimum. When this boy is promoted to elementary desk work he is given 25 to 30 yen per month. Men of the caliber of a tally clerk are paid 75 to 100 yen per month. A chauffeur for an automobile is paid about 80 yen per month, but to maintain a car costs about 250 yen per month, and an automobile is far more necessary in Tokyo than it is in an American city, as the other facilities for transportation are very unsatisfactory.

These figures are not presented as a complete estimate of the cost of opening an office in Japan. No such statement is possible in a report of this kind, as no two manufacturers would need just the same sort of an establishment; but these figures will show a few of the high lights, and each person may sketch in the details of the picture to illustrate his own problem.

On the domestic side the American resident in Tokyo finds the housing problem decidedly serious. Persons interested should read a special report on this subject (FE-174) issued by the Bureau of Foreign and Domestic Commerce, October 12, 1920.

Apart from being expensive, business in Japan is difficult. The language problem is expressed as follows in the British Board of Trade Journal for April 14, 1921:

> One can master the most difficult of European tongues in two or three years at the most, but a lifetime is not sufficient for the acquisition of a full and perfect knowledge of Japanese. * * * Japanese, particularly in its written form, is probably as difficult a language as exists in the world, yet hard work and patience will meet with their reward.

It is entirely impractical for a busy business man to acquire this language in addition to regular office duties. Missionaries find it necessary to devote several years exclusively to its study before they are qualified to undertake active work. Business plans for Japan should include ample allowance for assistance.

In addition to problems of this sort, it should be remembered that in Japan business must be conducted according to Japanese law, which differs radically from American law. The customs of the country also exert a strong influence even on business contracts, and one should not negotiate contracts in Japan without competent assistance in these matters.

PATENTS AND TRADE-MARKS.

Under the recently amended laws it appears that adequate protection may be obtained for foreign patents and trade-marks in Japan, provided the legal requirements are complied with. It must be remembered that the Japanese law recognizes the first registrant as the actual owner of the trade-mark, irrespective of its use. Moreover, the tendency seems to be to grant relief in case of infringement only when there is a palpable imitation of the registered mark. This emphasizes the necessity not only to secure prompt registration but also to register the mark as actually used, not merely its essential features. Under the Berne Convention of 1883 commercial names are protected without the formality of registration.

In view of the numerous instances of artful imitation, usually resulting in heavy loss of trade, careful consideration should be given to the matter of obtaining a Japanese patent before entering that market. Promptness in this case is also essential on legal grounds, in view of the fact that a patent can not be granted if the invention lacks novelty. In Japan an invention is not considered new if it had been used within the Empire before the patent application was filed or if it had received sufficient publicity to make manufacture possible. These regulations are waived only in case application is made under the provisions of the Berne Convention within one year of the filing date in the United States. In that case the date of the Japanese patent application corresponds with the date on which the original application was filed.

Because of the absence of definite legislation on the subject of industrial-property protection in China, the effect of the Japanese patent and trade-mark laws extends to China in case protection is sought against the unfair competitive practices of a Japanese subject. The complainant, however, must be able to prove prior registration in Japan in order to obtain legal protection in such cases. This feature of the trade situation in China is discussed on page 276.

TARIFF.

Japan is frankly protectionist in tariff policy. The duties on machinery vary greatly from one classification to another, and, altogether, fill several pages of the tariff schedule. Most of the duties are specific; where they are ad valorem, they range from 15 to 30 per cent. Many of the specific rates are less than these figures indicate. American machinery is not discriminated against under the Japanese law.

The rates on steam engines illustrate the way the Japanese tariff law has been framed, and are as follows (100 kin equals 133 pounds):

Each weighing not more than 250 kilos: 16 yen per 100 kin.
Each weighing not more than 1,000 kilos; 9 yen per 100 kin.
Each weighing not more than 5,000 kilos: 8 yen per 100 kin.
Each weighing not more than 50,000 kilos: 6 yen per 100 kin.
Each weighing not more than 100,000 kilos: 4.40 yen per 100 kin.
Other: 4 yen per 100 kin.

Two dollars per 133 pounds represents a very small ad valorem duty on a really large engine. If we assume such an engine to cost

30 cents per pound, c. i. f. Japan, it works out at about 5 per cent, but this applies only to an engine weighing more than 134 tons.

In view of the way in which this tariff is framed, it is absolutely necessary to have a good deal of information in order to prepare an accurate estimate of the cost of a given machine delivered, for example, in Kyoto. If the machine has heavy parts, knowledge of the gross weights and measurements of each package is needed in order to compute the ocean and lighterage freights under the lift scales. Similar gross weights are necessary in computing the freights on the American railways, with a different computation to cover the freights on the Japanese railways. Finally, the detailed weights are needed for customs purposes.

DETAILED STATISTICS OF MACHINERY TRADE.

The table beginning on the next page shows the imports of industrial machinery to Japan; the kin equals 1.323 pounds, and the value of the yen approximates 50 cents.

Classes.	1913 Kin.	1913 Yen.	1915 Kin.	1915 Yen.	1916 Kin.	1916 Yen.	1917 Kin.	1917 Yen.	1918 Kin.	1918 Yen.	1919 Kin.	1919 Yen.	1920 Kin.	1920 Yen.
Steam boilers and parts and accessories thereof:														
Asiatic Russia				476		70		6,430						
Great Britain		660,219		498,519		1,008,624		1,089,754		1,285,000		2,636,000		2,929,000
France				1,462		119,826								147,000
Germany		150,114		17,288		17,929		294				5,000		
Belgium		88,825												
United States		77,183		52,314		191,766		1,376,623		6,015,000		5,626,000		3,358,000
China								100,000						
Kwantung						4,434		29,257		116,000		6,000		1,000
Switzerland						11,140								
Unknown, and other countries				12		13,358		109,255		119,000		62,000		243,000
Total		976,341		570,071		1,367,147		2,711,613		7,535,000		8,335,000		[1] 6,680,000
Fuel economizers:														
China			1,725	224										
Great Britain	1,550,381	141,948	698,318	61,392	933,189	94,692	1,417,353	165,818	457,000	60,000	341,400	60,000	1,738,100	391,000
Germany	28,110	4,315												
United States					171,350	24,312	37,991	6,072	328,500	70,000	921,000	211,000	792,400	222,000
Unknown			2,300	299						1,000		1,000		
Total	1,578,491	146,263	702,343	61,915	1,104,539	119,004	1,455,344	171,890	785,500	131,000	1,262,400	272,000	2,530,500	613,000
Locomotives and tenders:														
Great Britain		43,116				3,308								6,000
Germany		671,884		140,153		2,950								9,000
Belgium		5,325												
United States		1,666,385		88,182		98,536		111,969		398,000		408,000		898,000
Kwantung						15,750								
Total		2,386,710		228,335		120,544		111,969		398,000		408,000		914,000
Steam locomotives, portable steam engines, and steam road rollers:														
Great Britain	96,689	22,556	33,292	8,933	20,925	6,010					5,600	3,000	28,400	16,000
Germany	40,285	12,108									45,400	20,000		
United States													247,400	164,000
Total	136,974	34,664	33,292	8,933	20,925	6,010					51,000	23,000	275,800	180,000

[1] For 1920, certain of these totals do not correspond exactly to the sum of the items; this discrepancy arises from the fact that, while figures below 1,000 are not shown for the several items, they are taken into consideration in the totals.

Steam turbines:														
France												56,000		
Great Britain		20,396				21,855								91,000
Switzerland												152,000		79,000
Germany		27,123												
United States		16,168		23,820		7,833		164,404		275,000		588,000		1,521,000
Sweden												37,000		
Others												3,000		9,000
Total		63,687		23,820		29,688		164,404		275,000		836,000		1,701,000
Steam engines:														
Great Britain	782,334	218,580	159,925	51,167	191,970	76,005	569,939	204,852	66,100	22,000	327,900	121,000	263,700	222,000
France	17,417	6,100			161,381	80,875	87,523	41,886			34,900	35,000		
Germany	763,925	222,801					90,440	42,300	5,900	2,000				
Belgium	331,158	94,217												
Switzerland											15,300	9,000		
United States	126,697	27,630	7,474	3,295	271,921	72,941	191,351	88,147	420,300	415,000	951,300	367,000	317,500	170,000
China							3,991	2,500						
Kwantung					2,450	222			14,900	13,000				
Asiatic Russia							1,757	675						
Unknown, and other countries					16,088	2,133	64,064	18,620	22,700	11,000	7,900	8,000	109,100	98,000
Total	2,021,531	569,328	167,399	54,462	643,810	232,176	1,009,065	398,980	529,900	463,000	1,337,300	540,000	690,800	491,000
Gas engines, petroleum engines, and hot-air engines:														
Kwantung	1,948	676							12,700	4,000			9,700	15,000
Great Britain	1,681,042	577,290	109,467	42,310	7,248	6,309	29,279	28,585	1,000	1,000	40,000	38,000	990,700	3,254,000
France	6,745	23,006			237,603	83,945							122,300	604,000
Germany	1,297,953	358,894			5,628	3,222	454	730					29,800	24,000
Belgium	23,859	6,900												
Italy	9,698	13,604											1,400	5,000
Switzerland	63,145	59,265												
Netherlands														
Sweden	139,091	96,668	126,491	45,413	18,153	16,578	29,717	48,395	6,300	15,000	73,100	160,000	21,700	44,000
United States	52,770	79,827	37,459	35,471	57,172	69,034	131,568	179,646	367,800	476,000	258,500	757,000	581,500	818,000
British America	143	122									1,800	4,000		
New Zealand											3,300	1,000		
Asiatic Russia					2,094	400	1,911	4,298	10,600	5,000	4,800	3,000	11,500	4,000
Unknown					479	420	7,204	1,150	4,700	4,000		3,000		
Total	3,276,394	1,216,252	273,417	163,194	328,377	179,908	200,133	262,804	403,100	505,000	381,500	966,000	1,768,600	4,771,000
Water turbines and Pelton wheels:														
Great Britain	125,198	36,992	82,189	23,668	30,550	11,595	43,128	23,047			685,500	637,000		
France	12,413	4,386	26,878	14,676	32,228	14,061			10,700	13,000	258,100	355,000	85,900	41,000
Germany	1,874,711	612,586	46,627	17,784									8,100	2,000
Belgium	35,798	14,406												
Italy	25,312	13,066											95,900	48,000

Classes.	1913		1915		1916		1917		1918		1919		1920	
	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.
Water turbines and Pelton wheels—Continued.														
Switzerland			20,966	9,965	4,751	3,210	306,822	132,926	51,800	32,000	625,700	778,000	108,400	91,000
Sweden	66,483	21,044	61,349	29,707	181,017	86,379	226,062	135,601	7,000	4,000			132,700	134,000
Denmark	104,182	25,901												
United States	1,579	491	22,999	20,560			29,215	14,072	34,100	32,000	10,300	15,000	380,800	460,000
Unknown									100	1,000		2,000		
Total	2,245,676	728,872	231,008	116,360	248,546	115,245	605,227	305,646	103,700	82,000	1,579,600	1,787,000	761,800	779,000
Dynamos, electric motors, transformers, converters, and armatures:														
China			1,020	798										
Kwantung	68	88	17	10	1,210	775			31,700	16,000	16,600	10,000	2,900	3,000
Great Britain	1,775,617	781,673	235,938	130,574	120,274	95,483	55,273	49,342	54,600	38,000	168,400	187,000	373,400	376,000
France	306	612	10	39	59,025	43,842					6,800	6,000	2,100	17,000
Germany	3,282,965	1,344,093	75,415	32,377	57,408	17,533	3,503	2,275					5,900	23,000
Belgium	40,004	14,968											700	4,000
Switzerland	73,652	48,816	4,327	3,102	19,197	14,242							42,900	66,000
Austria-Hungary	5,442	2,560												
Sweden	38,767	18,412	13,424	7,006	216	237					139,000	292,000	57,500	97,000
Russia			281	325										
Denmark											1,300	2,000		
United States	3,703,863	1,417,908	648,195	327,170	352,059	219,836	1,381,323	1,076,542	3,058,500	2,975,000	4,262,000	4,763,000	5,047,400	5,485,000
British America			5	5			217	275	600	2,000				
Asiatic Russia							1,678	1,200					2,800	3,000
Unknown					13	10	13	10	46,100		2,200	5,000		
Total	8,920,684	3,659,130	978,632	501,406	609,402	391,958	1,442,007	1,129,644	3,191,500	3,031,000	4,596,300	5,265,000	5,538,700	6,080,000
Dynamos combined with motive machinery:														
Great Britain		253,798		185,208		145,649		43,546						16,000
France		2,455												
Germany		116,277												
United States		258,481		62,921		247,320		490,718		483,000		431,000		529,000
Kwantung						740				1,000		105,000		
Switzerland						48,188								
Sweden								49,627		1,000		1,000		
Unknown, and other countries												199,000		137,000
Total		631,011		248,129		441,897		583,891		485,000		736,000		684,000

Other motive machinery:														
Great Britain		1,616												
United States				250								2,000		5,000
Total		1,616		250								2,000		5,000
Cranes:														
Great Britain	1,682,447	425,594	87,025	19,522			742,315	243,011	71,900	34,000	18,400	23,000	63,400	37,000
Germany	1,522,847	472,844												
Belgium	695	141												
Sweden	42,126	7,559					20,921	13,756	36,600	32,000				
United States	623,362	173,168	48,787	20,825	133,964	49,786	501,360	206,191	763,600	418,000	899,800	607,000	1,080,200	695,000
Kwantung					559	120	211,218	51,927						
Unknown							113,151	30,702	59,700	27,000		1,000		
Total	3,871,467	1,079,306	135,812	40,347	134,523	49,906	1,588,965	545,587	931,800	511,000	918,200	631,000	1,143,700	732,000
Capstans and other winding machines:														
Great Britain	809,581	350,594	249,759	71,761	287,069	58,566	164,301	41,683	44,300	16,000	76,600	27,000	314,000	134,000
Kwantung									59,200	21,000				
France														
Germany	99,122	30,740	23,463	7,2[illegible]7			1,388	833	6,800	1,000				
Belgium	14,155	4,246												
Sweden			4,635	3,271									7,900	5,000
United States	99,367	43,579	62,882	55,417	504,981	168,142	380,916	135,321	336,900	329,000	316,400	270,000	508,500	436,000
Asiatic Russia					2,809	350	2,509	50						
Australia							790	478						
Unknown					5,927	900	5,062	1,120	15,600	8,000	2,700	1,000		
Total	1,022,225	429,159	340,739	137,656	800,786	227,958	554,966	179,485	462,800	375,000	395,700	298,000	834,300	577,000
Gas compressors:														
Great Britain	160,717	107,081	25,781	14,712	148,675	71,332	60,795	30,851	88,500	24,000	45,000	39,000	184,200	128,000
France	9,640	2,991			21,972	9,404	92,031	61,072					16,700	15,000
Germany	49,171	23,579							2,000	1,000			2,500	2,000
Belgium	13,667	4,140												
Switzerland			9,461	5,131							700	1,000		
Sweden	12,777	13,669	21,095	19,049	2,203	4,630	6,703	15,113			2,300	2,000	21,300	91,000
United States	390,548	146,479	253,949	89,881	678,259	254,615	639,496	307,737	1,821,800	997,000	1,333,900	1,037,000	2,053,300	1,584,000
Unknown, and other countries							1,100	308	14,600	7,000		1,000	5,700	27,000
Total	636,520	297,939	310,286	128,773	851,109	339,981	800,125	415,081	1,926,900	1,029,000	1,381,900	1,080,000	2,283,700	1,848,000
Pumps:														
China				1,465										
Kwantung				515		5,654		953						3,000
Asiatic Russia				50		90		1,572						
Great Britain		611,589		182,398		93,245		124,734		116,000		172,000		256,000
France		9,704		3,651		19,042		29,313				24,000		36,000
Germany		164,370		8,560		188		662		5,000				7,000

Classes.	1913		1915		1916		1917		1918		1919		1920	
	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.
Pumps—Continued.														
Belgium		9,816												
Italy		294		100										2,000
Switzerland		11,295		3,417		7,994		39,773		15,000		35,000		5,000
Austria-Hungary														
Canada										14,000				1,000
Sweden		2,513		9,442		3,773		48,750		1,000		80,000		29,000
United States		271,612		57,162		121,452		308,163		678,000		1,069,000		1,251,000
Unknown						133		2,860		10,000		13,000		
Total		1,081,193		266,760		251,571		556,780		839,000		1,383,000		1,594,000
Blowing machines:														
Great Britain		111,603		37,332		33,578		67,619		14,000		48,000		55,000
France		9,372				362		654						
Germany		36,314		25				350						6,000
Belgium		10,124		549										
Italy		8,368		39										
Netherlands		15												
Switzerland										16,000		46,000		
United States		136,517		47,848		124,264		77,594		158,000		234,000		191,000
China								30						
Kwantung						30								
Austria-Hungary						371								
Canada						3,816								
Unknown, and other countries								51		2,000		1,000		17,000
Total		312,313		85,793		162,421		146,298		190,000		329,000		270,000
Hydraulic presses:														
Great Britain	143,980	29,303	48,979	8,160	74,191	12,708	31,286	4,161	429,700	146,000	120,100	40,000	445,200	116,000
Germany	13,094	5,174												
United States	1,699	709	20,616	15,069	211,448	204,945	7,960	2,874	243,800	101,000	419,900	180,000	596,100	446,000
Sweden							9,990	3,655			100			
Total	158,773	35,186	69,595	23,229	285,639	217,653	49,236	10,690	673,500	247,000	540,100	220,000	1,041,300	563,000
Metal or woodworking machinery:														
Kwantung			2,062	1,747	19,505	6,296	104,416	41,957	203,300	68,000	91,500	46,000	2,800	1,000
Great Britain	6,309,155	1,894,926	891,437	278,652	317,947	134,013	1,107,045	408,600	433,700	251,000	625,900	484,000	3,443,900	2,573,000
France	10,495	4,349	120	561	11,252	5,573	182	1,155			7,500	9,000	8,400	8,000
Germany	1,804,259	549,037	501,268	125,692	12,267	4,643	274	220					50,900	60,000
Asiatic Russia									4,200	2,000	3,600	1,000		

Canada									13,700	10,000				
Belgium	147,828	42,067											400	4,000
Italy											33,700	40,000		
Switzerland	365	1,513	263	1,181	6,279	7,461	2,782	1,409	1,300	1,000	100	1,000	1,800	5,000
Netherlands	13	7												
Sweden	6,370	4,202			3,666	3,377			4,600	10,000	4,300	9,000	23,400	31,000
United States	1,672,626	782,925	994,801	483,085	2,826,459	1,622,051	5,008,888	2,995,334	8,186,700	6,281,000	9,483,700	9,978,000	10,944,900	10,964,000
Unknown							15,947	3,508	52,500	23,000		2,000		
Total	9,951,111	3,279,026	2,389,971	890,918	3,197,385	1,783,414	6,239,534	3,452,183	8,900,000	6,641,000	10,250,300	10,565,000	14,478,300	13,650,000
Spinning machines:														
China	59	10	3,475	559										
Great Britain	22,071,766	4,812,270	4,585,558	1,283,818	7,125,731	2,024,266	13,216,243	4,194,541	8,739,400	3,270,000	9,885,800	4,734,000	20,817,000	10,499,000
France	18,023	9,516	10,849	7,134	424,985	184,599	27,321	16,872	389,000	476,000	1,140,400	1,435,000	71,700	68,000
Germany	697,625	214,019			8,911	1,850	129,583	38,700					135,600	109,000
Belgium	75	147												
Italy			5,483	2,663										
Switzerland	90	196									1,700	1,000	6,400	6,000
United States	59,152	33,635	66,238	39,569	263,134	195,477	1,208,261	541,373	8,487,000	4,810,000	10,682,300	7,693,000	10,387,800	7,477,000
Unknown, and other countries			20,268	1,836	16,823	2,350							3,800	2,000
Total	22,846,790	5,069,793	4,691,871	1,335,579	7,839,584	2,408,542	14,581,408	4,791,486	17,615,400	8,556,000	21,710,200	13,864,000	31,422,400	18,163,000
Weaving looms:														
Great Britain		494,785		290,575		88,278		404,722		629,000		897,000		751,000
France		17,726		52,802				115,619				2,000		
Germany		330,376												10,000
Belgium		2,532												
Switzerland				525				1,090				11,000		77,000
United States		4,197								27,000		478,000		519,000
Unknown, and other countries										1,000		3,000		15,000
Total		849,616		343,902		88,278		521,431		657,000		1,391,000		1,374,000
Tissue finishing machines:														
Great Britain	2,058,177	547,621	215,463	67,533	216,461	61,434	133,351	50,063	48,600	24,000	205,200	104,000	475,900	337,000
France	15,269	3,298	1,553	774									1,900	2,000
Germany	245,868	72,659	12,221	4,089	5,157	1,125							97,900	110,000
United States	381	309					2,177	2,671	3,000	4,000	200,600	201,000	225,400	262,000
Kwantung							715	272						
Russia							496	750						
Unknown, and other countries										1,000	100		4,200	3,000
Total	2,319,695	623,887	229,237	72,396	221,618	62,559	136,739	53,756	51,600	29,000	405,900	305,000	805,400	716,000
Knitting machines:														
Great Britain	5,646	7,784	28	67	303	688	1,169	2,619	4	1,000				
France	17,168	15,736			181	455							1,200	3,000

Classes.	1913		1915		1916		1917		1918		1919		1920	
	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.	Kin.	Yen.
Knitting machines—Continued.														
Germany	50,612	62,917	4,840	7,032	212	470							6,400	8,000
Belgium	31,830	28,774												
Switzerland	2,391	5,217	245	496	729	1,784	769	2,152			6,200	29,000	16,900	30,000
United States	20,264	17,465	281	495	22,887	26,123	87,841	133,283	66,500	149,000	241,100	593,000	111,400	270,000
China					23	30								
Unknown							111	150	1,300	1,000	800	1,000		
Total	127,911	137,893	5,394	8,090	24,335	29,550	89,890	138,204	68,200	151,000	248,100	623,000	136,600	314,000
Paper-making machines:														
Great Britain		70,532		12,841		235,215		241,395		8,000		324,000		373,000
Germany		82,762												
Switzerland												161,000		
Austria-Hungary														
Sweden		23,447		146,446		7,321		196,595				91,000		322,000
United States		12,131		31,662		49,927		58,007		1,112,000		2,350,000		2,522,000
Total		188,872		190,949		292,463		495,997		1,120,000		2,926,000		3,219,000
Ice-making machines:														
Great Britain		64,958												
Belgium		125												
United States		42,007		18		45,661		64,270		15,000		125,000		375,000
Total		107,090		18		45,661		64,270		15,000		125,000		375,000
Pneumatic tools:														
Great Britain			1,030	5,694	1,111	5,431	687	3,967	500	5,000	2,400	16,000	400	3,000
Sweden					31	259	1,755	12,945	3,300	39,000	6,300	53,000	1,700	14,000
United States			22,394	93,852	48,461	212,528	73,051	377,834	128,300	689,000	142,100	837,000	79,100	618,000
Total			23,424	99,546	49,603	218,218	75,493	394,746	132,100	733,000	150,800	906,000	81,400	637,000
All other machinery:														
Kwantung		1,398		686		103,692		3,268		161,000		1,000		6,000
Hongkong				35										
British India														
Great Britain		1,209,471		351,164		880,392		576,280		403,000		484,000		1,458,000
France		88,405		13,379		26,355		38,457		1,000		27,000		143,000
Germany		1,831,133		106,265		24,082		4,298						168,000
Belgium		110,508												2,000
Italy		16,962				974								8,000
Switzerland		650		1,244		2,375		420		3,000		16,000		18,000
Austria-Hungary		18,549												

Netherlands	....	714	....	....	....	....	....	....	....	12,000	....	....	....	1,000
Sweden	....	6,205	....	8,885	....	64,540	....	103,385	....	74,000	....	506,000	....	209,000
United States	....	1,604,557	....	545,215	....	1,480,426	....	3,353,721	....	5,222,000	....	10,083,000	....	13,642,000
China	....	....	....	....	....	45	....	....	....	2,000	....	....	....	2,000
Asiatic Russia	....	....	....	....	....	....	....	5,913	....	....	....	9,000	....	1,000
Norway	....	....	....	....	....	....	....	1,840	....	....	....	....	....	....
Canada	....	....	....	....	....	8	....	67	....	....	....	5,000	....	....
Australia	....	....	....	....	....	810	....	....	....	....	....	....	....	....
Hawaii	....	....	....	....	....	....	....	491	....	....	....	....	....	....
Unknown	....	....	....	1,714	....	695	....	2,586	....	41,000	....	11,000	....	....
Total	....	4,978,552	....	1,028,587	....	2,593,394	....	4,090,726	....	5,919,000	....	11,142,000	....	15,665,000

The following tables show the exports of machinery from the United States to Japan and to Chosen (Korea), according to official American statistics:

EXPORTS FROM UNITED STATES TO JAPAN

Classes.	1910 [1]		1913 [1]		1915 [1]	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery				7,626		28,264
Brewers' machinery				800		
Elevators and elevator machinery				27,423		15,989
Electric locomotives					3	11,629
Stationery gas engines			39	5,846	56	16,204
Gasoline engines:						
Automobile					6	315
Marine			43	15,316	19	3,548
Stationary			50	6,860	13	3,962
Steam engines:						
Locomotives	10	29,985	79	1,302,346	8	34,805
Marine					2	2,135
Stationary	18	9,105	10	9,389	1	2,900
All other engines			103	47,346	2	683
Parts of engines		46,078		78,069		40,860
Flour and grist mill machinery				340,613		13,739
Power laundry machinery		279		2,818		900
Metal-working machinery		87,160		119,558		86,166
Oil-well machinery						43,966
Other mining machinery		29,679		384,229		48,444
Paper and pulp mill machinery				17,136		15,552
Pumps and pumping machinery		101,062		80,113		37,468
Refrigerating, including ice-making, machinery				44,630		17,476
Shoe machinery		46		35		109
Sugar-mill machinery				68,200		10,218
Textile machinery				39,346		275
Sawmill machinery				22,215		11,980
Other woodworking machinery		11,499		19,078		3,033
All other machinery and parts of		1,426,509		675,443		239,494
Total		1,741,402		3,314,435		690,114

Classes.	1919		1920		1921	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Air-compressing machinery		354,168		723,453		520,906
Brewers' machinery		109,684		51,932		1,950
Concrete mixers		27,432		93,198		140,672
Cotton gins	3	195		21,155		1,670
Elevators and elevator machinery		173,048		218,584		596,860
Electric locomotives			2	10,288	15	69,960
Stationary gas engines	75	23,503	112	19,151	207	22,910
Gasoline engines:						
Automobile	79	37,194	152	58,815	9	5,627
Marine	453	108,796	599	175,142	426	96,164
Stationary	184	76,772	866	219,925	643	97,175
Traction	50	172,036	146	119,000	11	17,270
Kerosene engines	8	10,455	193	45,395	430	42,955
Steam engines:						
Locomotives	18	124,441	26	234,149	32	438,485
Marine	11	28,982	58	530,674	9	150,854
Stationary	17	18,642	34	311,093	7	78,104
Traction	2	11,810	5	24,826		
All other engines	76	178,174	558	293,065	161	292,762
Boilers		1,109,063		884,100		181,707
All other parts of engines		841,945		1,273,791		978,470
Excavating machinery		92,305		194,752		313,952
Flour and grist mill machinery		740,927		413,414		414,900
Power laundry machinery		17,486		11,936		53,324
Lathes		967,095		503,304		301,028
Other machine tools		635,874		956,784		430,462
Sharpening and grinding machines		452,233		494,154		198,236
All other metal-working machinery		3,327,982		2,296,341		1,706,292
Oil-well machinery		71,025		182,672		38,228
Other mining machinery		271,931		381,431		409,499
Paper and pulp mill machinery		1,473,277		467,919		691,583
Pumps and pumping machinery		386,579		733,661		250,219

[1] 1910, 1913, and 1915 are fiscal years ended June 30; the others are calendar years.